

Assessment of Research Quality

# **Institute of Veterinary Research**

**2012-2017**

**Final Version - 12 December 2018**

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## Summary

This report describes the assessment of research conducted at the Institute of Veterinary Research (IVR) of Utrecht University in the period 2012-2017. IVR is in charge of all biomedical and veterinary research that is performed at the Faculty of Veterinary Medicine of Utrecht University. The institute aims to unravel biological principles of animal health and disease, and their impact on public health and the environment. During the evaluation period, IVR research was organised into six programmes: Applied Veterinary Research (AVR), Fertility & Reproduction (F&R), Behaviour & Welfare (B&W), Regenerative Medicine, Stem cells & Cancer (RMSCC), Infection & Immunity (I&I), and Risk Assessment (RA). For strategic reasons, IVR reorganised its research into three themes in 2018: Veterinary Biomedicine, One Health, and Regenerative Medicine, Stem Cells & Cancer.

The assessment was performed by an external assessment committee using the 'Standard Evaluation Protocol 2015-2021'. The committee evaluated the research quality and societal relevance of the six programmes. In addition, the committee assessed the viability of the three themes. The committee evaluated IVR research based on the institute's self-evaluation report and interviews with IVR representatives and societal stakeholders during a site visit in October 2018. Table 1 summarises the assessment in numerical scores.

**Table 1:** Quantitative assessment of the quality, relevance, and viability of the IVR programmes and themes<sup>1</sup>

| Programme                              | Theme                  | Research quality | Relevance to society | Viability |
|--|------------------------|------------------|----------------------|-----------|
| Applied Veterinary Research (AVR)      | Veterinary Biomedicine | 2                | 2                    | 3         |
| Fertility & Reproduction (F&R)         |                        | 2                | 3                    |           |
| Behaviour & Welfare (B&W)              |                        | 2                | 2                    |           |
| Regen Med, Stem Cells & Cancer (RMSCC) | Regenerative Medicine  | 1                | 2                    | 1         |
| Infection & Immunity (I&I)             | One Health             | 1                | 1                    | 1         |
| Risk Assessment (RA)                   |                        | 1                | 1                    | 1         |

<sup>1</sup> The four possible categories are excellent (=1), very good (=2), good (=3), and unsatisfactory (=4). See Appendix 4 for an explanation of these scores.

In the committee's opinion, the **quality** of the IVR research programmes ranges from very good (AVR, F&R, and B&W) to excellent (RMSCC, I&I, and RA). The institute has published an impressive number of influential papers. The staff hold leading positions in international research networks, societies and committees, professional organisations, and evaluation panels. In addition, IVR harbours many state-of-the-art advanced technical facilities that are available to academic and industrial collaborators, thus further advancing science. The committee thinks that the quality of IVR research will further improve if veterinary clinical specialists are allocated sufficient time for research.

The societal **relevance** of the programmes ranges from good (F&R), to very good (AVR, B&W, RMSCC) and excellent (I&I, RA). The institute generates valuable knowledge to address urgent societal challenges such as infectious disease outbreaks, antibiotic resistance, food safety, environmental health & sustainability, and animal welfare. IVR has ample collaborations with industry to ensure that its basic research is translated into practical applications. In addition, IVR scientists have substantial societal impact with their expert comments, clinical guidelines, and advisory reports. They have

actively reached out to the general public, either directly or through various media. They have organised post-graduate training courses for veterinarians to ensure that the latest knowledge and views find their way to veterinary practice. The institute's efforts to reduce, refine, and replace animal experiments are highly appreciated by a variety of societal stakeholders.

In spite of its clear societal relevance, IVR struggles with its external appreciation and visibility. The committee spoke with a variety of societal stakeholders and obtained a mixed view: some stakeholders were extremely positive, whereas others were highly critical. This seems to pertain to two interrelated problems. First, the institute's external communication strategy is not optimal. Second, there appears to be a mismatch between IVR's research priorities and the needs and expectations of some stakeholders. The committee recommends devising a strong branding & communication strategy to tackle these problems.

The committee rates the **viability** of the Veterinary Biomedicine theme as good. Grouping the three programmes seems to be sensible given their limited size and earning capacity. The Veterinary Biomedicine theme is crucial to the veterinary identity of IVR and the topic of animal welfare is increasingly receiving societal attention. However, the programmes will need a solid plan on how to exploit their synergy. In addition, the Academic Veterinary Hospital seems to be at a critical point, facing significant challenges. The committee considers it crucial that IVR undertakes action to ensure that this theme will thrive. The viability of the other themes was judged as excellent.

This report discusses several issues that relate to the long-term sustainability of IVR and provides suggestions on how to improve the institute's viability. First, the committee recommends a variety of measures to safeguard the veterinary identity of IVR research, including collaborating with peripheral clinics, ensuring that veterinary clinical specialists have sufficient time for research, supporting the Veterinary Biomedicine theme, and ensuring sufficient interaction between basic and clinical scientists within all themes. Second, the committee has some general recommendations, including installing an external scientific advisory board, optimising human resources management to ensure that employees can excel, and adopting a more systematic approach to international collaboration.

The committee also considered the training and supervision of **PhD students** at IVR. These students are enrolled in Utrecht University's Graduate School of Life Sciences. The infrastructure to safeguard the PhD training is in place, but the practical implementation of these measures leaves some room for improvement. Recommendations include revisiting the selection procedure for PhD students, installing a mandatory introduction course, striving for more standardisation in the supervision and training, keeping a better administration of figures related to PhD students, establishing clear minimal requirements for PhD graduation, and providing more guidance to the job market.

Lastly, the committee considered IVR's **scientific integrity** policy and its **diversity** policy. The infrastructure to ensure research integrity is in place, but it would be good to ensure that all IVR employees are aware of the University's attitude towards matters such as reliability, verifiability, impartiality, and independence. Therefore, the committee recommends installing a mandatory primer or seminar on research integrity. As regards diversity, IVR has explicitly incorporated diversity as an important theme in its Strategic Plan 2017-2021. The committee encourages IVR to strive for more diversity in terms of gender, nationality, and background.

# 1. Introduction

## 1.1 Background

This report describes the assessment of the quality and relevance of research conducted at the Institute of Veterinary Research (IVR) of Utrecht University in the period 2012-2017. The assessment was performed by an external review committee using the Standard Evaluation Protocol (SEP) 2015-2021. The SEP was drawn up and adopted by the Royal Netherlands Academy of Arts and Sciences (KNAW), the Netherlands Organisation for Scientific Research (NWO), and Association of Universities in the Netherlands (VSNU). All research conducted at Dutch universities, University Medical Centres, and NWO or KNAW institutes is assessed once every six years in accordance with the SEP. The primary aim of SEP assessments is to evaluate the quality and relevance of academic research and to suggest improvements where necessary. SEP assessments focus on the strategic choices and future prospects of research groups.

Target groups that are served by this assessment include

- **IVR's scientists and management** want to know how the quality of IVR research, its societal relevance, and its strategy are perceived by independent experts and how these elements can be improved.
- **The Board of Utrecht University** wishes to track the impact of its research policy.
- **The Dutch government** wants to know the outcomes of assessments in connection with the institution's accountability for expenditure and its own efforts to support an outstanding research system.
- **Society and the private sector** seek to solve a variety of problems using the knowledge that IVR research delivers.

## 1.2 Members of the assessment committee

The Board of Utrecht University has appointed as members of the assessment committee:

- Professor Leo den Hartog, chair (Wageningen University, the Netherlands),
- Professor Gerald de Haan (University Medical Centre Groningen, the Netherlands),
- Professor Sylvie Daminet (Ghent University, Belgium),
- Professor Per Jensen (Linköping University, Sweden),
- Professor Erika von Mutius (University of Munich, Germany),
- Professor Bernd Kaspers (University of Munich, Germany).

Dr Linda van den Berg (Washoe Life Science Communications) served as the secretary to the assessment committee. Short CVs of the committee members are provided in Appendix 1. The evaluation and recommendations in this report constitute the committee's consensus.

## 1.3 Procedure

The committee evaluated IVR research based on the institute's self-evaluation report and interviews with IVR representatives (management, programme coordinators, theme leaders, PhD students, young talents, and representatives of the Graduate School of Life Sciences) and societal stakeholders during a site visit in October 2018. The site visit programme is listed in Appendix 2. Additional

reference materials included the conclusions and recommendations of the previous peer review committee (2012), two documents for PhD candidates of Utrecht University's Graduate School of Life Sciences (the template Training & Supervision Agreement and the quality assurance plan of research, training, and supervision), short CVs of principal investigators, and the results of a 2017 personnel satisfaction survey. The committee considered international trends and developments in science and society as it formed its judgement.

#### *Assessment of IVR research*

The committee made a qualitative and quantitative judgement of IVR based on three assessment criteria:

1. **research quality**, i.e., the quality of IVR research, the contribution of IVR research to the body of scientific knowledge, and the scale of IVR's research results (scientific publications, instruments and infrastructure developed by IVR, and other contributions to science).
2. **relevance to society**, i.e., quality, scale, and relevance of contributions (advisory reports for policy, contributions to public debates, etc.) targeting groups that IVR has itself designated as target groups (amongst others: veterinary and human patients, veterinarians, farmers, animal breeders, pet owners, industry, various civil and governmental organisations).
3. **viability**, i.e., the strategy that IVR intends to pursue in the years ahead, the extent to which it can meet its targets in research and society during this period, and the governance and leadership skills of IVR's management.

#### *Assessment of IVR's PhD programme*

The committee also considered the supervision and training of PhD candidates at IVR. During the site visit, the committee interviewed five PhD students, who were in different stages of the PhD track. The committee did not know how these students were selected, but assumed that these individuals provided opinions that are representative of the group at large. The following topics were covered:

- selection and admission procedures,
- institutional context of the PhD programme,
- programme content and structure,
- supervision and the effectiveness of programme plans and supervision plans,
- quality assurance,
- guidance of PhD candidates for the job market,
- duration, success rate, exit numbers, and career prospects.

#### *Assessment of IVR's research integrity policy and diversity policy*

The committee considered IVR's policy on research integrity and the way in which violations of such integrity are prevented. The committee was interested in how IVR deals with scientific integrity and the extent to which a critical pursuit of science occurs at IVR. In addition, the committee evaluated IVR's efforts to ensure a diverse staff composition from the junior through the senior scientist level.

## 2. The Institute of Veterinary Research

The Institute of Veterinary Research (IVR) aims to unravel biological principles of animal health and disease and their impact on public health and the environment. The institute is in charge of all biomedical and veterinary research that is performed at the Faculty of Veterinary Medicine (FVM) of Utrecht University (UU). The FVM is the only veterinary faculty in the Netherlands. Its departments are in charge of the primary tasks of scientific research and veterinary student education. To support these primary tasks, the FVM offers specialist veterinary healthcare in one of the largest academic veterinary hospitals in Europe.

### 2.1 IVR at a glance

#### *Research organisation*

The FVM harbours eight departments, each comprising multiple research groups. During the evaluation period, these research groups participated in six interdepartmental research programmes (see Table 2 on page 9):

- Applied Veterinary Research (AVR), coordinated by Professor Mirjam Nielen,
- Fertility & Reproduction (F&R), coordinated by Professor Tom Stout,
- Behaviour & Welfare (B&W), coordinated by Professor Louk Vanderschuren,
- Regenerative Medicine, Stem cells & Cancer (RMSCC), coordinated by Professor Alain de Bruin,
- Infection & Immunity (I&I), coordinated by Professor Henk Haagsman,
- Risk Assessment (RA), coordinated by Professor Roel Vermeulen.

For strategic reasons (see section 2.2), IVR research was reorganised into three themes in January 2018:

- Veterinary Biomedicine, coordinated by Professor Hans Kooistra and Dr Franck Meijboom,
- Regenerative Medicine, Stem cells & Cancer, coordinated by Professors Alain de Bruin and Marianna Tryfonidou,
- One Health, coordinated by Professors Frank van Kuppeveld and Roel Vermeulen.

#### *Management*

In the period 2012-2017, IVR was managed by the vice dean for research of the FVM (Professor Jos van Putten) in close collaboration with the Deputy Director (Dr Freek van Muiswinkel). In October 2017, Dr Maartje van Kempen-Noorman became the Managing Director of IVR, succeeding Dr Van Muiswinkel. She heads the Research Support Office, that assists the scientific staff in fund raising and business development. The IVR management advises on research strategy, the recruitment of senior staff, the allocation of research budget, investments in research infrastructure, and strategic alliances. During the evaluation period, the six programme coordinators acted as a Strategic Advisory Board to the IVR management. Appointed by the dean of the FVM, the programme coordinators directed operational aspects of the programmes. In addition, they discussed the general research direction, coherence, performance, and funding opportunities with the departmental research group leaders. As of January 2018, this Strategic Advisory Board has been replaced by the IVR Research Council, which consists of the six above-mentioned theme coordinators. These coordinators have

also been appointed by the dean. The Research Council has the same responsibilities as the Strategic Advisory Board, but has a stronger coordination role, steering on research quality.

### *Staff*

In 2017, the IVR research staff consisted of 425 employees, representing approximately 219 full-time equivalents (FTE): 86 FTE senior scientific staff members, 29 FTE postdocs, 98 FTE PhD students, and 5 FTE specialists in training (residents). In addition, the institute had approximately 57 FTE support staff members and visiting fellows. The total number of research staff members decreased slightly during the evaluation period, and staff numbers underwent considerable changes at the research programme level. Further details about the IVR staff are provided in Table 1.1 of Appendix 3.

### *Funding*

IVR has an annual budget of approximately 26.7 million euros. Around 45% of IVR funding is direct funding by the Ministry of Education, Culture, and Science (through the UU). This basic funding is distributed over the six programmes depending on programme size, the number of PhD defences, the programme's ability to attract external funding, and the number of high-quality publications. The remaining 55% of the budget is acquired through external grants. IVR's main external funding sources were national funding agencies such as NWO, ZonMw, and STW (so-called 'second money flow', amounting to ~15% of the budget) and the European Union, government, industry and charity ('third money flow', amounting to ~40% of the budget). IVR's funding sources are gradually shifting from second to third money flow, which aligns with the increasing societal appreciation of applied research. Further details about IVR's funding are provided in Table 2.1 of Appendix 3.

### *Facilities and expert centres*

IVR harbours several shared research facilities, including a Flow Cytometry Facility, Centre for Cellular Imaging, MS-lipidomics Facility, Single Cell Analysis Centre, and the Dutch Molecular Pathology Centre. In addition, the FVM harbours several expert centres, including the 3Rs-Centre Utrecht Life Sciences, Centre for Sustainable Animal Stewardship, Veterinary Forensic Expert, UU Centre of Genetics of Companion Animals, UU Animal Cancer Centre, and Dutch Wildlife Health Centre.

Utrecht University has heavily invested in cutting-edge technology centres and facilities for life science research in recent years. As a result, the UU campus is home to a variety of core facilities that are easily accessible to IVR scientists, including facilities for high-throughput RNA/DNA analysis, MS-based proteomics and metabolomics, bioinformatics & computing, high throughput screening (HC/HT), antibody/nano production, additive tissue manufacturing and tissue farming, NMR & X-ray crystallography, electron microscopy, large particle flow cytometry, fluorescence microscopy, single cell analysis, and high-performance computing.



**Table 2:** IVR research organisation in the period 2006-present

| Programmes 2006-2014                                 | Renamed programmes with research lines 2015-2017  | Themes per January 2018   |
|--|---|---|
| Advances in Veterinary Medicine                      | Applied Veterinary Research (AVR)<br>1. Clin Sci Comp Anim (Kooistra/Hesselink),<br>2. Farm Anim Health (Nielen),<br>3. Equine Sci (Sloet van O-O)<br>4. Pathobiology (Gröne).  | <b>Veterinary Biomedicine</b><br><br>• Involved in 3Rs-Centre ULS, Centre for Sustainable Animal Stewardship, Veterinary Forensic Expert Centre, UU Center of Genetics of Companion Animals, and UU Animal Cancer Center.   |
| Biology of Reproductive Cells                        | Fertility & Reproduction (F&R)<br>1. Helms group,<br>2. Stoorvogel group,<br>3. Stout group.  |   |
| Emotion & Cognition                                  | Behaviour & Welfare (B&W)<br>1. Behav Neurosci (Vanderschuren),<br>2. Anim Behav & Welfare (Ohl/Hellebrekers/Heesterbeek),<br>3. Emot & Cogn Farm Anim (van der Staay/Nordquist).   |   |
| Tissue Repair  | Regen Med, Stem Cells, Cancer (RMSCC)<br>1. Bone & Cartilage Regen (van Weeren/ Malda, Tryfonidou),<br>2. Liver Regen (Spee/Penning),<br>3. Lipids & Regen (Helms/Berkers),<br>4. Genetic Musc Disord (Geijsen),<br>5. Mol Pathol Cancer (de Bruin),<br>6. Comp Transl Oncol (Mol/Hesselink). | <b>Regenerative Medicine, Stem Cells &amp; Cancer</b><br><br>• Regen Med & Stem Cells also is a research domain of the UU strategic research theme 'Life Sciences'.<br>• Involved in Regenerative Medicine Center Utrecht and the national RegMed XB.<br>• Involved in UU Animal Cancer Centre. |
| Strategic Infection Biology                          | One Health - Infection & Immunity (I&I)<br>1. Cell Infect Mech,<br>2. Host Defence,<br>3. Infect Dynamics.<br><br>Group coordinators: Van Kuppeveld, Van Putten, Haagsman, Van Eden, Gröne, Stegeman, Helms, Stoorvogel.  | <b>One Health</b><br><br>• One Health also is a research domain of the UU strategic research theme 'Life Sciences'.<br>• Involved in the Netherlands Centre for One Health.<br>• Involved in the Dutch Wildlife Health Centre.  |
| Risk Assessment of Toxic and Immunomodulatory Agents | One Health - Risk Assessment (RA)<br>1. Exposure Assessm & Cntrl (Brunekreef/Vermeulen),<br>2. Mech Action & Dose-resp assess (van den Berg),<br>3. Environm & host resp modul (van Eden),<br>4. Environm Epidemiol (Heederik).   |   |

## 2.2 IVR's strategy and targets

### *Mission*

The overall aim of IVR is to unravel biological principles of animal health and disease and their impact on public health and the environment. This knowledge should provide a basis for novel strategies that benefit animal and human health, veterinary practice, and the society as a whole. This ambition requires multidisciplinary expertise over the entire spectrum from molecule to population. Strong relationships with public and private stakeholders contribute to translation and application of scientific progress in the community.

### *Reorganisations*

In the period 2012-2017, IVR attempted to organise its research into a limited number of societal relevant interdisciplinary research programmes with sufficient focus and mass to be at the forefront of science in their respective fields. In addition, the institute strived to incorporate evidence-based veterinary medicine as an integral part of the research programmes. To create more focus, IVR slightly reorganised the research programmes in 2015. The programmes were renamed (see Table 2) and the 'One Health' theme was established as an umbrella over the I&I and RA programmes. One Health refers to the collaborative effort of multiple disciplines to attain optimal health for people, animals, and the environment. Infectious disease research of the AVR programme was incorporated into the One Health programmes in 2015.

In January 2018, the AVR, F&R, and B&W programmes were brought together to create the Veterinary Biomedicine theme. This was done to create more mass, coherence, visibility, and funding opportunities. As a result, IVR research is currently organised into three themes: Veterinary Biomedicine, Regenerative Medicine, Stem cells & Cancer, and One Health. With the formation of these three themes, the institute expects to create focus and to foster societal challenge-driven interdisciplinary research.

### *Strategic alliances*

Forging local and national strategic alliances is an explicit part of IVR's strategy. During the review period, the institute has actively invested in strategic alliances with partners such as the University Medical Centre Utrecht (UMCU), Utrecht University's Faculty of Science, the Hubrecht Institute, the Dutch government (e.g., Dutch Wildlife Health Centre), and industry (e.g., Castellum consortium).

The RMSCC theme and the One Health theme are particularly well-embedded in several initiatives at the Utrecht University campus:

- UU focuses its research on four strategic themes, one of which is 'Life Sciences'. The Life Sciences theme in turn consists of the research domains Regenerative Medicine & Stem Cells, One Health, Personalised Medicine & Health, and Science for Life. These domains are organised as interdisciplinary clusters of research groups from the faculties of Science, Medicine, and Veterinary Medicine. Joint policies and investments in infrastructure have created synergy and an attractive scientific environment. IVR scientists are actively involved in the research domains Regenerative Medicine & Stem Cells, and One Health.
- UU has invested in seven specific research focus areas in addition to the four strategic themes: Applied Data Science, Education for Learning Societies, Foundations of Complex Systems, Game

Research, Integrative Bioinformatics for Life Sciences and Sustainability, Professional Performance, and Sport & Society. These research focus areas should help UU create a more focused institutional profile.

- Together with its partners, UU will address fourteen key societal challenges. To this end, the university will allocate 26 million euros for the period 2018-2022. The collaboration takes place in fourteen hubs within the UU strategic research themes. Hubs aim to truly join forces with partners to ponder research questions and strategies, rather than applying or valorising previously acquired academic knowledge. Hubs within the Life Sciences theme include the Utrecht Exposome Hub, Utrecht Molecular Immunology Hub, Utrecht Advanced in Vitro Model Hub, and Utrecht Platform for Organoid Technology. The Future Food hub of the Pathways to Sustainability theme is also of interest to IVR.
- The Regenerative Medicine Centre Utrecht (RMCU) has been established as a collaboration between the UMCU, Hubrecht Institute, and IVR. The RMCU focuses on tissue bioengineering for clinical application in humans and animals. In the end of 2018, the majority of RMSCC scientists of IVR will physically move into a common RMCU building on the campus.

At the national level, IVR has initiated the Netherlands Centre for One Health (NCOH), which sets the agenda for research on major societal issues such as antimicrobial resistance and emerging infectious diseases. It is an alliance of the Amsterdam Medical Center, Erasmus MC (Rotterdam), KNAW, Leiden University Medical Center, Leiden University, Radboud University Medical Center (Nijmegen), UMCU, Utrecht University, and Wageningen University. The NCOH is also home to the National Antibiotic Development Platform. The RMSCC theme participates in the national REGenerative MEDicine crossing Borders initiative (RegMed XB), which is a public-private partnership in the area of tissue regeneration. IVR and the UMCU also started a long-term collaboration with Twente University in the field of tissue bioengineering. The FVM has set up a Centre for Sustainable Animal Stewardship together with Wageningen University & Research.

#### *Strategy 2017-2021*

The FVM has drawn up a Strategic Plan 2017-2021 for its research, education, and veterinary healthcare. Key points related to research include:

- In the coming years, the Faculty will focus on the three research themes Veterinary Biomedicine, One Medicine (i.e., RMSCC), and One Health. The themes are connected by Sustainable Animal Stewardship: knowledge of and insight in the sustainable and responsible treatment of animals in society. The Faculty plans to use its reserves for targeted investments in the research themes and in research talent, increasing its chances to attract personal grants and top research facilities.
- They will strategically invest in international collaboration and form new local, national, and international alliances. This is expected to increase the institute's attractiveness to top researchers. IVR will strengthen synergy and cost-effectiveness by physically clustering facilities and research groups (e.g., in the RMCU and a new One Health building).
- The Faculty aspires to interact stronger with society at the national and international level. They want to position themselves in the public arena as a veterinary knowledge centre, for instance by organising debates. They wish to act as a network organisation, strongly interacting with partners in veterinary fields such as livestock farming, veterinary public health, and the veterinary

profession. They will also network with adjacent scientific disciplines, in particular those related to public health.

- The FVM plans to restructure its departmental organisation in 2020. The current eight departments will be reorganised into three departments that align with the three research themes. This is expected to smoothen the coordination of research activities between different research disciplines.

### 3. Assessment of the Veterinary Biomedicine theme

The Veterinary Biomedicine theme is composed of the research programmes Applied Veterinary Research, Fertility & Reproduction, and Behaviour & Welfare. The theme strengthens the scientific basis of veterinary healthcare by studying healthy and diseased animals. In this chapter, the committee first evaluates the scientific quality and societal relevance of the three programmes (sections 3.1-3.3) and then comments on the viability of the overarching theme (section 3.4).

#### 3.1 Applied Veterinary Research programme: quality and relevance

|                       |  |
|-----------------------|--|
| <b>Coordinator:</b>   | Professor Hans Kooistra (end of 2017 - present),<br>Professor Mirjam Nielen (2012 - 2017) <sup>1</sup> |
| <b>Staff in 2017:</b> | 23.6 FTE total research staff, 15.3 FTE senior scientific staff,<br>see Table 1.2 in Appendix 3        |
| <b>Funding:</b>       | see Table 2.2 in Appendix 3  |

The Applied Veterinary Research programme (AVR) provides the scientific basis for high-quality veterinary patient care. It constitutes the clinical veterinary signature of IVR research. AVR is essential for veterinary specialisation, i.e., for creating the next generation of research scientists and veterinary clinical specialists. In addition, it provides research time to the clinical staff of the FVM, so that they can maintain their board certification. AVR responds quickly to acute veterinary problems and societal questions regarding animal health and welfare. All AVR group leaders are veterinary specialists that are firmly embedded in the Faculty's (para)clinical departments. With 23.6 FTE total research staff in 2017, AVR is one of the smaller IVR programmes.

Since January 2015, AVR has comprised four research groups with corresponding research lines:

- The **Clinical Sciences of Companion Animals** group of Professor Hans Kooistra aims to elucidate the pathogenesis of companion animal diseases. They develop diagnostic tests, prognostic markers, and therapies. The UU Center of Genetics of Companion Animals is embedded in this group. In addition, the group participates in the UU Animal Cancer Center, which is a knowledge centre for veterinary and comparative oncology.
- The **Farm Animal Health** group of Professor Mirjam Nielen tackles research questions in bovine, porcine, and avian health, health management, and welfare. The groups run trials within their own facilities or on commercial farms within the University Farm Animal Practice, leading to better evidence on treatment and control of endemic animal diseases.
- The **Equine Sciences** group of Professor Marianne Sloet van Oldruitenborgh-Oosterbaan improves clinical knowledge and pushes technical advancements in evidence-based equine medicine and tries to answer research questions that are relevant to the field.

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<sup>1</sup> Note that the dates in brackets are limited to the review period. For instance, Professor Nielen already coordinated the AVR programme before 2012, but the dates in brackets refer to the review period only.

- The **Pathobiology** group of Professor Andrea Gröne focusses on the pathogenesis of clinically or societal relevant diseases and welfare in companion animals, farm animals, horses, and wildlife (with a focus on marine mammals).

#### *Research quality*

The AVR programme performs **very good** research on a diverse range of veterinary topics. During the review period, around 13% of their papers were published in journals in the top 25% of all ISI fields. Although this percentage is very low compared to the other programmes, it has increased slightly in the last few years. In addition, AVR had the highest output of the six IVR programmes, with an annual average of around six publications per FTE total staff. With an average of 1.7 million euros of external funding per year, their earnings are intermediate compared to the other programmes. However, their earnings have decreased in the last few years, which is worrying. Examples of research highlights include the research on the pathophysiology of adrenal gland tumours in dogs based on a large adrenal tissue database, the establishment of the UU Center of Genetics of Companion Animals, and the organisation of a multicentre clinical trial on intra-articular medication in horses.

The committee concludes that the AVR programme has done very well given the limited amount of time that its scientists have available for research. It is expected that the quality of AVR research will improve substantially if clinical scientists are allocated more time for research. This will be discussed in more detail later in this report.

#### *Relevance to society*

The AVR programme is **very relevant** to society, in particular to stakeholders from the veterinary field. AVR research facilitates the development of diagnostic tests, prognostic markers, and therapies, supporting evidence-based veterinary healthcare. In addition, they write diagnostic and therapeutic guidelines that are used by veterinarians. The programme provides evidence-based answers to acute veterinary problems and societal questions regarding animal health and welfare. They also contribute to society by training the next generation of veterinarians, veterinary specialists, and clinical scientists. Their research provides insight into the pathogenesis of diseases in animals, which may be translated to human diseases. Examples of societal highlights include the contribution to the knowledge on health and disease in many different species, such as marine mammal health, feather picking in parrots, genetic disorders such as dwarfism, bovine neonatal pancytopenia, and pain recognition in horses. Societal impact also includes the contribution to the Veterinary Forensic Expert Centre (see section 3.3).

### **3.2 Fertility & Reproduction programme: quality & relevance**

|                       |  |
|-----------------------|--|
| <b>Coordinator:</b>   | Professor Tom Stout (April 2015 - present),<br>Professor Willem Stoorvogel (2012 - April 2015) |
| <b>Staff in 2017:</b> | 10.5 FTE total research staff, 5.0 FTE senior scientific staff,<br>see Table 1.3 in Appendix 3 |
| <b>Funding:</b>       | see Table 2.3 in Appendix 3  |

The Fertility & Reproduction programme (F&R) aims to provide solutions to problems affecting or arising from reproduction in domestic animals and humans. F&R consists of three research groups: the groups of Professor Bernd Helms, Professor Willem Stoorvogel, and Professor Tom Stout. These groups investigate molecular mechanisms and pathways involved in gamete development, fertilisation, embryogenesis, and implantation. They also study the requirements for successful gamete or embryo storage and they investigate how early embryonic cells either maintain their pluripotent state or embark on directed differentiation. Another research topic is the developmental origins of health and disease, i.e., the effect of environmental exposures of mature gametes and early embryos on the long-term (epigenetic) modification of gene expression and pregnancy survival and offspring susceptibility to disease. Their focus is on epigenetics, implantation, and biofabrication. With only 10.5 FTE total research staff, F&R constitutes the smallest IVR programme.

*Research quality*

The quality of F&R research is **very good**. Although the number of publications per staff member is relatively low (2.5 per year on average), the quality of their publications is high and has increased over the review period. Almost half of their publications were in journals in the top 25% of ISI fields in the period 2012-2017. With an average of 0.55 million euros of external funding per year, the earning capacity of F&R is very low and decreasing, which is worrying. Examples of research highlights include the development of an oviduct-on-a-chip (which can assist in IVF, preventing polyspermy and other problems) and the work on chromosome segregation.

*Relevance to society*

The F&R programme has a modest but **relevant** contribution to society, in particular to horse breeding, cattle IVF and embryo freezing, and animal conservation. In addition to its veterinary relevance, F&R research results may also inform studies of assisted reproduction technologies and pregnancy loss in humans, especially when large animal models are more suitable than traditional models. The programme has plans to establish a ‘University Centre for Equine Fertility’ to offer assisted reproduction and molecular diagnosis of sub-fertility. The committee supports this initiative as it would align with the needs of the sector and promote clinically relevant research.

**3.3 Behaviour & Welfare programme: quality and relevance**

|                       |   |
|-----------------------|---|
| <b>Coordinator:</b>   | Professor Louk Vanderschuren (2012-present)   |
| <b>Staff in 2017:</b> | 14.0 FTE total research staff, 6.7 FTE senior scientific staff<br>see Table 1.4 in Appendix 3 |
| <b>Funding:</b>       | see Table 2.4 in Appendix 3   |

The Behaviour & Welfare programme (B&W) aspires to play an internationally leading role in animal welfare research, in order to understand, safeguard, and improve animal welfare. They develop and improve concepts of animal welfare as a fundament to their research. With 14.0 FTE total research staff in 2017, B&W is the second-smallest IVR programme. B&W consists of three research groups with corresponding research lines:

- The **Behavioural Neuroscience** group of Professor Louk Vanderschuren studies how positive emotions like reward and motivation and their modulation by cognitive control mechanisms guide adaptive behaviours that contribute to animal welfare. Research topics include the neural underpinnings of social play behaviour, impulsive behaviour & decision making, and substance addiction.
- The **Animal Behaviour and Welfare** group of Professor Hans Heesterbeek (2016-present), the late Professor Frauke Ohl (2012-2016), and Professor Ludo Hellebrekers (2012-2015) aims to bridge the gap between the common-sense public understanding of animal welfare, the ethically sound considerations, and the biological reality of the animal's perception of its own status. To this end, they also develop, validate, and apply research tools to assess behaviour and welfare in the laboratory and in real life.
- The **Emotions and Cognition in Farm Animals** group of Dr Rebecca Nordquist (2016-present) and Professor Franz Josef Van der Staay (2012-2016) studies emotional and cognitive capacities of pigs and poultry, and the effects of farming and management practices in early life on these capacities later in life.

#### *Research quality*

The B&W programme performs **very good** research. The number of publications per staff member is low (2.7 per year on average) and decreasing. The percentage of publications in journals in the top 25% of ISI fields is also low compared to most other IVR programmes (around 37%). However, the programme published a number of influential papers. An example of a research highlight is the demonstration that social play behaviour in rats is affected by prefrontal and subcortical limbic mechanisms. This work adds considerably to our understanding of a behaviour that is highly relevant to welfare. Another highlight is the finding that learning and memory in pigs can be drastically affected by iron deficiency in the pre-weaning period. The contribution of the B&W programme to the societally important research theme 'Sustainable Animal Stewardship' has been of central importance. B&W's research tools to assess animal behaviour and welfare in the laboratory and in real life are available for academic collaborators and others, thus contributing to science and society in addition to supporting the programme's own research.

The committee concludes that B&W has performed well given the small amount of FTE and the turbulent times it experienced as a result of the untimely passing of Professor Frauke Ohl and several other changes in governance. The earning capacity of the programme is increasing and they have recently appointed several new principal investigators. This is expected to have a positive impact on the quality of B&W research.

#### *Relevance to society*

The B&W programme is **very relevant** to society, in particular the animal welfare work. B&W scientists develop new conceptual approaches to assessing, safeguarding, and improving animal welfare. They have developed animal welfare assessment tools, policy-advising reports, and lectures and videoclips on animal welfare. As society's interest in animal welfare has grown substantially in the last few years, B&W research is clearly meeting a societal need. Their neuro-behavioural research may benefit human mental health patients by providing insight in basic neural mechanisms related to mental health.



B&W has also contributed to society by initiating three expert centres: the 3Rs-Centre ULS, Centre for Sustainable Animal Stewardship, and Veterinary Forensic Expert Centre. These centres all contribute to animal welfare in their own way. The 3Rs-Centre ULS aims to promote alternatives to animal use. Established by the UU Faculties of Veterinary Medicine, Science, and Medicine in 2012, the centre stimulates the development, acceptance, and implementation of 3Rs methods (i.e., replacement, reduction, and refinement of animal experiments). For instance, the centre disseminates knowledge via a dedicated website and newsletters and it advises scientists within Utrecht Life Sciences. This work is highly appreciated by the animal protection organisations that the committee met during the site visit.

In 2016, the FVM established the Centre for Sustainable Animal Stewardship in collaboration with Wageningen University & Research. This centre aims to create space for a constructive dialogue on animal-related issues. In addition, it contributes to a sustainable and responsible relationship between humans and animals by considering economic and veterinary issues, as well as moral, political and emotional aspects. The concept of Sustainable Animal Stewardship also plays a central role in the FVM strategy for the years to come, constituting the common thread between the three research themes.

In 2017, the FVM launched a Veterinary Forensic Expert Centre. In this centre, forensic experts and specialised veterinarians provide advice to veterinarians that encounter potential cases of animal abuse. If necessary, the centre involves the police to identify and prosecute perpetrators. In addition, they perform research on the perpetrators. Because of the association between animal abuse and domestic violence, the centre collaborates with the National Expert Centre on Child Abuse. The centre thus has a clear societal relevance.

### **3.4 Viability of the Veterinary Biomedicine theme**

To strengthen the research profile and visibility of AVR, F&R, and B&W, these programmes were grouped into the overarching 'Veterinary Biomedicine' theme in January 2018. The theme coordinators (Professor Hans Kooistra and Dr Franck Meijboom) have played a crucial role in developing the theme. They have done so in a very commendable way, not least given the fact that there have been some dramatic and unexpected changes in the senior staff composition. The coordinators have the ambition to stimulate interdisciplinary cooperation between the three programmes. To this end, they have identified three joint research topics: animal welfare, genetics, and sensor data. They plan to collaborate intensively with research groups at IVR (e.g., on prudent use of antimicrobials and hormones with the One Health theme), UU (e.g., the UU Future Food Hub, the UU strategic theme Dynamics of Youth, and the Brain Center Rudolf Magnus), other Dutch research institutions (e.g., Wageningen University & Research), and international institutions. In addition, they plan to invest in young potentials. The FVM has allocated a strategic budget of 200,000 euros to support these plans. Among other things, this money will be spent on microgrants for collaborative projects and on organising joint meetings.

Overall, the committee rates the viability of the Veterinary Biomedicine theme as **good**. Grouping the three programmes seems to be sensible given their limited size and earning capacity. The Veterinary Biomedicine theme is crucial to the veterinary identity of IVR and the topic of animal welfare is

increasingly receiving societal attention. Moreover, the FVM strategy for the period 2017-2021 nominates Sustainable Animal Stewardship as the common thread between the three IVR research themes.

However, the overarching theme appears to be a cosmetic construction at present, with little interaction between the programmes. Admittedly, the theme was launched only recently and they will need time to establish internal collaborations. However, the programmes do not seem to have a solid plan on how to exploit their synergy. As a result, the committee is not convinced that the research quality and earning capacity will increase as a result of the merger. It will be very difficult for the theme to become viable if the programmes are not given a strong incentive to collaborate. As this theme has a strong veterinary signature, the committee considers it crucial that the FVM undertakes action to ensure that this theme will thrive. In the following paragraphs, we will discuss a number of topics that are important to the viability of the Veterinary Biomedicine theme. Chapter 8 contains recommendations to improve the theme's viability.

### *Funding*

The AVR, F&R, and B&W programmes report difficulties in attracting external funding for clinically-oriented veterinary research. In particular, it is challenging for this type of research to compete for second money flow. Indeed, these programmes have a low earning capacity compared to the other IVR programmes. This is problematic because the amount of UU basic funding depends on the amount of external funding obtained. In the last few years, AVR has been relatively successful in obtaining third money flow for animal patients. In addition, AVR has a good plan for exploiting fourth money flow (e.g., charities, private funds, legacies, and crowd-funding). The earning capacity of the F&R programme went down over the review period, which is worrisome. The earning capacity of B&W went up and the Dutch National Research Agenda offers funding opportunities for B&W research. The committee encourages the Veterinary Biomedicine theme to continue to explore the opportunities for fund raising beyond the second money flow.

### *Clinical research*

As the Veterinary Biomedicine theme constitutes the veterinary signature of IVR, developments related to the FVM Academic Veterinary Hospital and its clinical specialists are highly relevant to the viability of the theme. We will summarise some issues here and elaborate on them in the section about IVR as a whole (section 6.3):

- The Veterinary Biomedicine theme experiences difficulties in recruiting and retaining high-quality staff, in particular veterinary clinical specialists. This largely is the result of the recent emergence of peripheral veterinary specialist clinics in the Netherlands, who compete with the FVM for personnel. In addition, there is a national trend towards less interest in farm animal health. As a result, a position for a fulltime professor at the department of Farm Animal Health has remained vacant for several years now, in spite of substantial efforts to fill the position by the Faculty management.
- The committee was surprised to find out that veterinary clinical specialists at the FVM are often not allocated sufficient time for research. In view of the problem in recruiting clinical personnel sketched above and the fact that the opportunity to perform research may attract talented specialists, this seems an unfortunate situation.

- The Veterinary Biomedicine and RMSCC theme have plans to jointly establish a so-called ‘advanced therapy centre’ for veterinary patients. This centre would run clinical trials to study the efficacy of novel therapies in animal patients. It would offer state-of-the-art veterinary care to referred animal patients, while also utilising them as naturally occurring animal models for human diseases and treatments (i.e., the One Medicine approach). The committee considers this a high-risk project, but it will contribute substantially to the viability of the Veterinary Biomedicine theme if it is successful.

### 3.5 Summary in numerical scores

In line with the qualitative judgements of Veterinary Biomedicine research described in this chapter, the committee has assigned the research programmes and the overarching theme to a discrete category for each of the assessment criteria. The four possible categories are excellent (=1), very good (=2), good (=3), and unsatisfactory (=4). The scores are explained in more detail in Appendix 4 of this report.

**Table 3:** Quantitative assessment of Veterinary Biomedicine research

| <b>Programme</b>            | <b>Theme</b>           | <b>Research quality</b> | <b>Relevance to society</b> | <b>Viability</b> |
|-----------------------------|------------------------|-------------------------|-----------------------------|------------------|
| Applied Veterinary Research | Veterinary Biomedicine | 2                       | 2                           | 3                |
| Fertility & Reproduction    |                        | 2                       | 3                           |                  |
| Behaviour & Welfare         |                        | 2                       | 2                           |                  |

## 4. Assessment of the Regenerative Medicine, Stem Cells & Cancer theme

Regenerative Medicine, Stem cells & Cancer (RMSCC) scientists focus on developing innovative therapies for chronic diseases that affect both animals and humans (i.e., the One Medicine concept). In this chapter, the committee first evaluates the quality and societal relevance of RMSCC research (section 4.1) and then comments of the viability of the theme (section 4.2).

### 4.1 Regenerative Medicine, Stem cells & Cancer: quality and relevance

|                       |  |
|-----------------------|--|
| <b>Coordinator:</b>   | Professor Alain de Bruin   |
| <b>Staff in 2017:</b> | 32.1 FTE total research staff, 13.6 FTE senior scientific staff<br>see Table 1.5 in Appendix 3 |
| <b>Funding:</b>       | see Table 2.5 in Appendix 3  |

RMSCC scientists seek to develop new therapeutic strategies for destructive chronic diseases affecting large populations of animals and humans. The focus is on degenerative diseases of the liver and the (neuro)musculoskeletal system and on cancer. They employ stem cells and innovative technologies in their research. With 32.1 FTE total research staff in 2017, RMSCC is of intermediate size compared to the other IVR programmes. During the review period, RMSCC research comprised six research lines:

- The research group of Professor van Weeren and Professor Malda, and the group of Professor Tryfonidou work on **Bone and Cartilage Regeneration**. They develop new therapeutic approaches for musculoskeletal disorders. These could be applied in veterinary patients and translated to the human clinic. The groups have expertise in animal models (experimental animals and veterinary patients), biofabrication technologies, and sustained drug delivery studies.
- The **Liver Regeneration** group of Dr Spee and Dr Penning develops novel therapeutic options to treat chronic liver disease in veterinary and human patients. They develop biofabrication technologies (e.g., bioprinting, bioreactor-technology, reprogramming) to aid their studies.
- The **Lipids & Regeneration** group of Professor Helms and Professor Berkers develops novel (high-throughput) lipidomic and metabolomics techniques. Research topics include lipid metabolism and accumulation in hepatic stellate cells, the role of metabolic rewiring in the sensitivity of tumour cells to anti-cancer therapies, and the role of cells in the tumour microenvironment in supporting metabolism-mediated drug resistance. In addition, they aim to reveal novel therapeutic targets that can be exploited for treatment.
- The **Genetic Muscular Disorders** group of Professor Geijsen uses stem cells to model genetic muscular diseases. They have developed a novel protein transduction technology and are currently broadening the range of its application. They are also using the technology to study genetic neuromuscular diseases.
- The **Molecular Pathology of Cancer** group of Professor de Bruin has developed techniques and *in vivo* models to study the pathobiology of cancer. They focus on the Rb/E2F pathway, ultimately

aiming to develop novel therapy strategies. In addition, they have developed a blood test for early detection of tumour growth and monitoring cancer therapy response. The test could potentially be used to measure the efficacy of tissue regeneration after surgery or injury.

- The **Comparative and Translational Oncology** group of Dr Mol and Professor Hesselink aims to improve and share the knowledge on treatment and prevention of cancer in companion animals. The group is embedded in the UU Animal Cancer Centre. They focus on mammary carcinoma, adrenocortical tumours, osteosarcoma, and lymphoma. Research topics include cancer stem cell inhibitors and the development of new image-guided therapeutic modalities.

#### *Research quality*

RMSCC scientists perform world class research. On average, the RMSCC staff published around 3.4 papers per year in the period 2012-2017. Around 47% of these papers were in the top 25% of ISI fields. With an average of almost 2 million euros of external funding per year, the earning capacity of RMSCC is intermediate, but includes a number of highly prestigious grants. An example of a research highlight is the demonstration that embryo-like structures (blastoids) can be generated *in vitro* using pluripotent and trophoectoderm cell lines as starting material. This work may have major implications for research on early mammalian development and it may call for novel legislation. In addition, very significant progress on CRISPR technology has been made, which has led to potentially valuable patents and commercial spin-off activities.

The RMSCC research groups have established a number of excellent research facilities that support the groups' research. These facilities offer expertise on biofabrication, genome editing, lipid analysis, single cell analysis, mouse pathology, and treating animal patients. The facilities are available to scientists at academic and industrial organisations in the Netherlands and abroad, thus further advancing science. The molecular pathology centre, for example, constitutes a highly successful and (inter)nationally unique facility that is used by many outside collaborators. Taken together, the committee considers RMSCC's contributions to science as **excellent**.

#### *Relevance to society*

RMSCC's work is **very relevant** to society, although the relevance varies between the research groups. RMSCC scientists develop therapies for human and veterinary patients that suffer from liver diseases, intervertebral disc disease, osteoarthritis, and cancer. These therapies result in an improved quality of life and more affordable healthcare. Examples of societal highlights are the successful 3D tissue printing and implantation of these tissues in patients, the development of the iTOP method for protein transduction, the development of canine & feline liver organoid technology, the work on minimally invasive local treatment of low back pain, and the discovery of E2F as a target for liver cancer therapy. RMSCC scientists successfully collaborate with industrial partners to ensure that their research results are translated into clinical applications that benefit human patients. In addition, they collaborate with veterinary clinical specialists to translate their results to veterinary healthcare. The committee particularly values the work on osteoarthritis and disc degeneration, where collaborations with industry have led to promising avenues in both human and veterinary healthcare.

#### **4.2 Viability of the Regenerative Medicine, Stem Cells & Cancer theme**

The viability of the RMSCC theme is rated as **excellent**, in particular for the groups that will move to the Regenerative Medicine Centre Utrecht. The theme is led by two highly motivated, visionary, and complementary leaders, who are very capable of moving RMSCC forward. They strongly position and align the IVR component of regenerative medicine in Utrecht. The RMSCC research is strong and the research groups have clearly worked on their synergy since the last evaluation. Although the theme covers quite a broad variety of research topics, there are many collaborations between the groups and they appear to form an enthusiastic community. They capitalise on the success of Hubrecht Institute in a smart way, and provide unique expertise to Hubrecht Institute. The theme is involved in several initiatives at the UU campus, including two research domains of the UU strategic research theme Life Sciences (Regenerative Medicine & Stem Cells and Personalised Medicine & Health) and two Hubs (Utrecht Advanced in Vitro Model Hub and the Utrecht Platform for Organoid Technology). In addition, they have forged strategic alliances with technical universities, UMCs, other academic institutes, and industrial parties throughout the Netherlands.

The RMSCC theme is remarkably successful in combining veterinary and human-oriented research and in combining basic and applied research. The committee applauds the 'One Medicine' approach, where veterinary and human-oriented research are intertwined. For instance, in the RMSCC research on osteoarthritis and lower back pain, veterinary and human clinicians collaborate and animal patients serve as future customers as well as large animal models for humans. Another example is the biofabrication of innovative 3D printed tissues that have been successfully transplanted into human and equine patients to treat osteochondral defects.

##### *Funding*

RMSCC scientists have demonstrated their ability to obtain prestigious grants, for instance from the European Commission, NWO, patient organisations, and the Morris Animal Foundation. However, most of these grants seem to have been obtained by a small number of principal investigators and the theme's earning capacity is modest. The committee encourages the RMSCC theme to improve this.

##### *Regenerative Medicine Centre Utrecht*

As mentioned in section 2.2, the majority of RMSCC scientists will move into the Regenerative Medicine Centre Utrecht (RMCU) building before the end of 2018. The RMCU is a collaboration between IVR, the UMCU, and the Hubrecht Institute, focusing on tissue bioengineering for clinical applications in humans and animals. IVR will support this development with additional research budget (200,000 euros). The committee anticipates that co-housing Utrecht's regenerative medicine experts will further boost the research quality of these groups. However, there is a substantial risk that the veterinary signature of the RMSCC work will eventually be lost after the move because the RMCU building is on the other side of the UU campus. Employees that will be hired after the move may not feel affiliated to the FVM. The RMSCC theme has developed an interaction plan to ensure lasting scientific collaborations between its basic and clinical scientists. One component of this plan is to develop funding roadmaps for collaborative research projects. Every three months, they will actively explore new ideas for collaborations, creating a community feeling. The committee

encourages the RMSCC theme to continue along this line and continuously monitor if basic and clinical scientists are sufficiently interacting.

*Advanced therapy centre and veterinary clinical specialists*

Another component of the above-mentioned interaction plan is the ‘advanced therapy centre’ for veterinary patients that RMSCC wants to establish together with the Veterinary Biomedicine theme. As mentioned in section 3.4, this centre would offer state-of-the-art veterinary care to referred animal patients, while also utilising them as naturally occurring animal models for human diseases and treatments. This is a unique and high-risk project, but it will contribute substantially to the viability of the themes if it is successful. The committee would like to stress that lasting scientific collaborations between basic and clinical scientists will only be possible if veterinary clinical specialists have sufficient time for research. As mentioned in the section about the Veterinary Biomedicine theme, the committee is concerned about the amount of time that veterinary clinical specialists at the FVM can spend on research, which appears to be only 5% in some cases. This is a structural problem, which should be solved for IVR as a whole.

**4.3 Summary in numerical scores**

In line with the qualitative judgements of Regenerative Medicine, Stem Cells & Cancer research described in this chapter, the committee has assigned the research theme to a discrete category for each of the assessment criteria. The four possible categories are excellent (=1), very good (=2), good (=3), and unsatisfactory (=4). The scores are explained in more detail in Appendix 4 of this report.

**Table 4:** Quantitative assessment of Regenerative Medicine research

| <b>Programme</b>              | <b>Theme</b>          | <b>Research quality</b> | <b>Relevance to society</b> | <b>Viability</b> |
|-------------------------------|-----------------------|-------------------------|-----------------------------|------------------|
| Regen Med, Stem Cells, Cancer | Regenerative Medicine | 1                       | 2                           | 1                |

## 5. Assessment of the One Health theme

The One Health theme is composed of the research programmes Infection & Immunity and Risk Assessment. The theme seeks to understand the interactions between animals, people and their environment. In this chapter, the committee first evaluates the scientific quality and societal relevance of the two programmes (sections 5.1 and 5.2) and then comments of the viability of the overarching theme (section 5.3).

### 5.1 Infection & Immunity programme: quality and relevance

|                       |  |
|-----------------------|--|
| <b>Coordinator:</b>   | Professor Henk Haagsman  |
| <b>Staff in 2017:</b> | 90.9 FTE total research staff, 28.3 FTE senior scientific staff<br>see Table 1.6 in Appendix 3 |
| <b>Funding:</b>       | see Table 2.6 in Appendix 3  |

The Infection & Immunity (I&I) programme aims to develop novel intervention and prevention strategies for animal and human infections. This is done by unravelling mechanisms of infection, empowering the host defence, and reducing the need to use antimicrobials. With around 91 FTE of total scientific staff in 2017, it constitutes the largest IVR research programme. I&I consists of eight research groups coordinated by professors Van Kuppeveld, Van Putten, Haagsman, Van Eden, Gröne, Stegeman, Helms, and Stoorvogel. During the evaluation period, these groups worked in three interconnected research lines:

- The **Cellular Infection Mechanisms** research line studies the molecular mechanisms that drive cellular infection and associated changes in host cell biology, focussing on specific pathogens. Overarching research topics include nidoviruses & influenza, bacterial mucosal interactions, and host cell membrane dynamics. The common theme within this research line is the interaction of healthy and harmful microbial agents with host cells.
- The **Host Defence** research line aims to dissect the innate and adaptive host response to commensal and pathogenic microbes at the molecular level. Overarching research topics are innate defence, adaptive immune response, immunomodulation, and protection-inducing antigens.
- The **Infection Dynamics** research line studies infection dynamics at the molecular, animal, and population level. They seek to define common principles of (re-)emergence, course, persistence, and cycles of infection at the organ, host, and population level. In addition, they evaluate novel infection prevention and intervention strategies. Research topics are pathogen plasticity, complex infection models, population infection dynamics, and molecular infection prevention & intervention.



### *Research quality*

The quality of IVR's research on infection and immunity is **excellent**. I&I researchers have published many high impact scientific papers over the review period, in journals such as Science, Nature, Nature brand journals, PNAS, Cell Host & Microbe, and Cell Reports. Around 61% of their papers were in the top 25% of ISI fields. The excellent research quality is also reflected by the high earning capacity of this programme; their mean annual earnings were 7.7 million euros in the period 2012-2017. Examples of research highlights include the work on betacoronavirus adaptation to the human respiratory tract, the identification of proteasome-catalyzed spliced epitopes targeted by CD8+ T Cells, and the modelling of infectious disease dynamics.

### *Relevance to society*

The work of the I&I programme is **highly relevant** to society. I&I scientists work on topics that are highly relevant to animal health, human public health, and the economy, including antimicrobial resistance, emerging infectious diseases, and zoonotic infections. They have ample collaborations with industry to translate their results (both contract research and public-private partnerships). Their basic research results have been translated into a very large number of clinical applications such as vaccines, adjuvants, alternatives to antimicrobials, antivirals, immunomodulators, and diagnostic products. In addition, they frequently provide policy advice on veterinary, public health, and environmental issues, for instance upon request of the Dutch government.

Both I&I and RA have contributed to society by initiating the Netherlands Centre for One Health (NCOH). NCOH joins Dutch academic research institutes that are active in One Health research with other leading parties. It is an open innovation network that takes joint responsibility for finding answers to global One Health challenges. In addition, I&I and RA have established a One Health MSc education programme, which contributes to society by training the next generation of One Health experts.

## **5.2 Risk Assessment programme: quality and relevance**

|                       |  |
|-----------------------|--|
| <b>Coordinator:</b>   | Professor Roel Vermeulen (2016-present),<br>Professor Martin van den Berg (2012-2016)          |
| <b>Staff in 2017:</b> | 48.7 FTE total research staff, 17.4 FTE senior scientific staff<br>see Table 1.7 in Appendix 3 |
| <b>Funding:</b>       | see Table 2.7 in Appendix 3  |

The Risk Assessment programme (RA) aims to improve the scientific basis to assess the risk associated with exposure to potentially harmful agents in the environment, in occupational settings, through vaccination, and through the food chain. They study risks to humans, animals, and ecosystems. To this end, they integrate mechanistic and observational epidemiological studies. The programme covers research from molecule to population, resulting in the development and evaluation of intervention and prevention tools. With 48.7 total research staff in 2017, this is the second-largest IVR programme. During the evaluation period, RA consisted of four research groups with corresponding research lines:

- The **Exposure Assessment & Control** research line of Professor Brunekreef (2012-2017) and Professor Vermeulen (November 2017-present) aims to identify and characterise physical, biological, and chemical factors in the environment that affect human, animal, and ecosystem health. In addition, they quantify routes of exposure in general, occupational, and domestic environments.
- The **Mechanism of Action & Dose-response Assessment** line of Professor van den Berg (from February 2018 Professor Legler) studies the availability, dose, and mechanism of action of pharmaceuticals, biotoxins, food & health products, and environmental contaminants in relation to their potential to induce adverse immune, neural, and endocrine effects. In addition, they develop novel *in vitro* methods to reduce the number of animals tested and to develop prediction methods for the *in vivo* situation.
- The **Environment & Host Response Modulation** line of Professor van Eden studies immune modulation in relation to chronic immune-mediated diseases (e.g., allergies and autoimmune diseases). They also study immunological mechanisms of agents such as microbial components (including vaccines), probiotics, adjuvants, chemicals, pharmaceuticals, and aeroallergens.
- The **Environmental Epidemiology** line of Professor Heederik studies the relationship between exposure to biological (e.g., bacterial toxins and allergens), physical, and chemical agents and health effects in human populations in the general environment, and in domestic and occupational settings. They perform studies with a special focus on veterinary public health issues resulting from interactions between animals and humans, their resulting exposures, and possible adverse health effects.

#### *Research quality*

The quality of IVR's risk assessment research is **excellent**. They are the best in Europe in exposure assessment and their international visibility is very high. In the period 2012-2017, they published more than five papers per FTE total staff per year on average and 68% of their scientific papers were in the top 25% of ISI fields (i.e., the best of all IVR programmes). This percentage is increasing, with 76% of their publications in the top 25% in 2017. The excellent research quality is also reflected by the high earning capacity of this programme; their mean annual earnings were 5.8 million euros in the period 2012-2017. Examples of research highlights include the European Study of Cohorts for Air Pollution Effects (ESCAPE), the large EU funded EXPOSOMICS project, and the studies focussing on microbiome and respiratory health at the interface between animal and human populations. In addition, RA scientists have been involved in the initiation and maintenance of a variety of population cohorts in the Utrecht area. These cohorts constitute rich study resources for scientists within and outside IVR. The committee considers this programme unique in their field.

#### *Relevance to society*

The work of the RA programme is **highly relevant** to society. RA research results enable evidence-based and cost-effective decisions on public health policies related to food safety, antibiotic resistance, zoonoses, risks of chemical and physical agents in the environment, and more. The stakeholders that were interviewed by the committee were very positive about the societal impact of the RA programme. For instance, RA scientists are active participants of advisory committees for the Dutch Health Council. The Dutch Health Council values RA scientists as highly acknowledged experts, especially in the fields of occupational and environmental medicine. RA scientists have also been actively involved in the establishment of the Utrecht Exposome Hub. Funded by Utrecht University,

this Hub brings together 45 researchers from five faculties to accelerate microbiome and exposome research in close collaboration with external partners. As mentioned in section 5.1, I&I and RA have also contributed to society by initiating the Netherlands Centre for One Health and establishing a One Health MSc education programme.

### 5.3 Viability of the One Health theme

#### *Infection & Immunity*

The committee rates the viability of One Health-Infection & Immunity as **excellent**. The I&I scientists are leaders in the veterinary immunology field worldwide. This specific field is shrinking at other research locations in the world, so Utrecht is expected to become even more leading in the future. In addition, I&I research addresses the pressing societal needs to prevent and treat infections, combat antimicrobial resistance, and develop alternatives to antibiotics. It will therefore remain highly relevant in the future. The I&I scientists have demonstrated their ability to obtain prestigious grants (e.g., from NWO, ZonMw, and the EU) and they have an impressive earning capacity (7.2 million euros of external money in 2017). They have also established strong (inter)national networks such as the Castellum and ALTANT consortia. Their visibility to industry is high and they have good earnings from contract research on topics such as FIPV, IBV, flu, and PEDV. The committee praises the theme's focus. For instance, they have decided not to work on I&I in fish and rather collaborate with Wageningen University & Research on this topic. The programme has several upcoming retirements, which offers opportunities to rejuvenate the staff.

#### *Risk Assessment*

The committee rates the viability of One Health - Risk Assessment as **excellent**. The RA groups are true leaders in their field. The governance and leadership skills of the theme coordinators are outstanding, with vision and preparedness for future research challenges in their field. Their earning capacity is not as high as for I&I and it decreased substantially during the evaluation period (from 8.1 million euros in 2012 to 2.7 million euros in 2017). However, they have proven to be successful in agenda setting (in EU funding programmes and in the Dutch National Science Agenda) and there appear to be ample funding opportunities on the horizon. The programme reports difficulties in recruiting good quantitative epidemiologists and bioinformaticians, and in filling vacant positions in general. For instance, they have had a vacant position for a veterinary public health professor for quite some time now. The leaders' approach to wait for an outstanding candidate rather than a rapid but less talented substitution shows the meritorious thrive to excel of this group.

The majority of RA scientists are employed by the Institute for Risk Assessment Sciences (IRAS), which is a collaboration between the FVM, the Faculty of Science, and UMCU. As a result, RA research often focuses on human health. For instance, only one of RA's five most important scientific publications in the self-report was related to veterinary health. The committee encourages RA scientists to stay interested in animals.

#### *One Health*

The overarching One Health theme was established in 2015. In the period 2015-2018, I&I and RA research was gradually reorganised into six new sub-programmes, which are more thematic than the original research lines. This was done to preserve the high quality of the research programmes and to

prepare for the societal challenges ahead. Now, One Health- I&I focuses on the biological mechanisms underlying microbe-related One Health challenges, whereas One Health- RA studies the population and environmental aspects of One Health. Research on One Health meets an urgent societal challenge, which will may make it relatively easy for this theme to obtain funding. In addition, IVR will invest two million euros in One Health research in the period 2018-2021, on top of the regular research budget. This will be spent on research (hiring PhD students and a principal investigator on complex cell systems), education, and community building (yearly meetings and research visits). The committee encourages the research groups to increase their interactions and build a close One Health community. There are plans to construct a One Health building at the FVM campus, which would also house the UMCU scientists that work on One Health. This will strengthen the theme because co-housing facilitates collaborations. In addition, future graduates from the One Health Master’s programme may strengthen the community.

The One Health theme is well-embedded in local, national, and international initiatives and consortia, which adds substantially to its viability. Locally, the theme perfectly aligns with the One Health research domain of Utrecht University’s strategic theme Life Sciences. Several UU Hubs offer opportunities to tackle key societal challenges together with academic and industrial partners (Utrecht Advanced In Vitro Models Hub, Utrecht Molecular Immunology Hub, Utrecht Platform for Organoid Technology, Utrecht Exosome Hub). Nationally, the theme is embedded in the National Centre for One Health (NCOH). Taken together, the committee considers the One Health theme excellently equipped to meet its targets in science and society in the coming years.

#### 5.4 Summary in numerical scores

In line with the qualitative judgements of One Health research described above, the committee has assigned the research programmes and the theme to a discrete category for each of the assessment criteria. The four possible categories are excellent (=1), very good (=2), good (=3), and unsatisfactory (=4). The scores are explained in more detail in Appendix 4 of this report.

**Table 4:** Quantitative assessment of One Health research

| <b>Programme</b>     | <b>Theme</b> | <b>Research quality</b> | <b>Relevance to society</b> | <b>Viability</b> |
|----------------------|--------------|-------------------------|-----------------------------|------------------|
| Infection & Immunity | One Health   | 1                       | 1                           | 1                |
| Risk Assessment      |              | 1                       | 1                           | 1                |

## 6. Assessment of IVR as a whole

### 6.1 IVR research quality

Overall, the committee considers IVR research as world class, although the scientific quality substantially varies between the research groups. Of the 458 scientific papers that the institute published in 2017, 34% appeared in scientific journals with an impact factor that ranked in the top 10% of any ISI field. The mean impact factor of these 458 papers was 5.0. Although the number of publications decreased during the evaluation period (along with the number of scientific staff members), the quality of the publications appears to have improved, as shown by an increasing impact factor of the journals. The staff hold leading positions in international research networks, societies and committees, professional organisations, and evaluation panels. In addition, a broad variety of stakeholders acknowledged the quality of IVR research during the site visit. Although the committee heard some critical remarks about the renewal of basic laboratory equipment, IVR harbours many state-of-the-art advanced technical facilities. The institute's facilities are available to scientists at academic and industrial organisations in the Netherlands and abroad, thus further contributing to the advancement of science.

### 6.2 IVR relevance to society

IVR generates valuable knowledge to address urgent societal challenges such as infectious disease outbreaks, antibiotic resistance, food safety, environmental health & sustainability, and animal welfare (including alternatives for animal experiments). The institute's research provides the basis to develop novel strategies to improve animal and human health & welfare, veterinary practice, and society as a whole. IVR has ample collaborations with industry to ensure that its basic research is translated into practical applications. In addition, it is actively involved in various initiatives where academic and industrial partners jointly address societal challenges (e.g., the UU Hubs). The UU Holdings and the Research Support Office of the FVM assist scientists in valorising their research results.

During the review period, IVR scientists also had substantial societal impact with their expert comments (up to 200 per year), clinical guidelines, and advisory reports. Their guidelines covered generic topics such as patient recording, systematic clinical approach, and the use of antimicrobials in veterinary practice. In addition, they produced reports on more specific subjects such as antimicrobial dry cow treatment, *Streptococcus suis* in weaned piglets, start-up of veal calves, start-up of broilers, urinary tract infections in dogs and cats, bacterial skin infections in dogs and cats, *otitis externa* in dogs and cats, and rhinopneumonia in horses. They published several advisory reports, for instance for the Dutch Health Council, World Health Organisation, EU, NGOs, the Council for Animal Affairs, Veterinary Medicines Authority, the Scottish Natural Heritage, and the Federation of Veterinarians in Europe.

In addition, IVR scientists have actively reached out to the general public, either directly or through various media. They have organised post-graduate training courses for veterinarians to ensure that

the latest knowledge and views find their way to veterinary practice. The institute's efforts to reduce, refine, and replace animal experiments are highly appreciated by a variety of societal stakeholders. These efforts contribute to animal welfare and result in better models, which will improve human healthcare in the long run. Examples are IVR's participation in the Utrecht Advanced in Vitro Model Hub and an initiative to encourage pet owners to donate their deceased pet for anatomy lessons.

In spite of its clear societal relevance as sketched above, the institute struggles with its external appreciation and visibility. The committee spoke with a variety of societal stakeholders and obtained a mixed view: some stakeholders were extremely positive, whereas others were highly critical. This seems to pertain to two interrelated problems. First, the institute's external communication strategy is not optimal. As a result, the institute's achievements and expertise are not sufficiently visible to outsiders.

Second, there appears to be a mismatch between IVR's research priorities and the needs and expectations of some stakeholders. It is the committee's opinion that a small institute will never be able to cover all possible topics. Therefore, it is imperative to make strategic choices. In addition, it is crucial that an academic institute critically pursues science and decides on its own research direction. This implies that IVR will not be able to cater to the needs of all stakeholders. However, it is important that the institute maintains an interactive dialogue with its stakeholders. IVR should clearly communicate its strategic choices, so that stakeholders know what to expect.

The mismatch with the needs of some stakeholders also appears to be caused by a gradual shift in the institute's scientific attention: IVR also focuses on research to the benefit of human health and healthcare, which has often resulted in very high impact publications in journals such as Nature and Science. Being the only veterinary faculty in the Netherlands, it is however crucial that IVR also keeps a strong focus on veterinary health and healthcare. The committee acknowledges that it may be easier to attract funding for human-oriented research. However, it appears that IVR is missing out on funding opportunities as a result of the mismatch with stakeholders' expectations. If IVR could manage to better align its research priorities with stakeholders' needs, without sacrificing its autonomy, it may find that additional opportunities to obtain funding for animal-oriented research emerge.

### **6.3 IVR viability**

During the site visit, the committee observed an institute that harbours several world-class research groups and has a substantial impact on society. The leaders of IVR appear to be well in control and aware of the challenges within the institute. The committee is particularly positive about the viability of the themes that fit into the priorities of Utrecht University (i.e., Regenerative medicine & stem cells and One Health). However, the Academic Veterinary Hospital seems to be at a critical point, facing challenges that threaten the veterinary component of IVR research. In the paragraphs below, we will discuss several issues that are important to the long-term sustainability of IVR. Chapter 8 provides recommendations to improve the institute's viability.

### *Academic Veterinary Hospital*

A substantial proportion of difficulties that IVR is currently experiencing relate to the Faculty's Academic Veterinary Hospital and its clinical specialists. IVR experiences difficulties in recruiting and retaining good staff, in particular veterinary clinical specialists. This largely is the result of the recent emergence of peripheral veterinary specialist clinics in the Netherlands, who compete with the FVM for personnel. In addition, there is a national trend towards less interest in farm animal health and Wageningen University & Research is increasingly focusing on farm animal health. As a result, it has been particularly difficult for the FVM to recruit talented clinical specialists and scientists in this field.

The committee was surprised to find out that veterinary specialists at the FVM are often not given sufficient time for research. On average, residents dedicated about 13% of their time to research. The committee met several veterinary clinical specialists that could spend only 5% of their time on research. This is disadvantageous for the viability of IVR for several reasons. First, it makes it impossible to achieve the highest possible research quality. Second, it frustrates collaborations between basic and clinical scientists (i.e., collaboration is impossible if veterinary clinical specialists are always swamped). Lastly, the opportunity to advance the specialist field through research and teaching constitutes the Faculty's unique selling point compared to peripheral clinics. The FVM should foster its attractiveness to veterinary clinical specialists: time for significant and relevant research, an interactive team of specialists, and -very uniquely- the possibility to intensively collaborate with excellent basic scientists at the campus. The committee also had the impression that IVR has insufficient data on how much time its personnel (especially residents) are spending on research. Such data are required to be able to improve the situation.

IVR has plans to establish a so-called 'advanced therapy centre' for veterinary patients. As mentioned in chapters 3 and 4, this collaboration of the Veterinary Biomedicine and RMSCC themes would run clinical trials to study the efficacy of novel therapies in animal patients. It would offer state-of-the-art veterinary care to referred animal patients, while also utilising them as naturally occurring animal models for human diseases and treatments (i.e., the One Medicine approach). The themes are currently considering which disease fields the centre should focus on; cancer and endocrine diseases are potential common themes. This research would constitute a bridge between preclinical model studies and phase I clinical trials in humans. The centre would be equipped with a proper research infrastructure (e.g., a case manager, a study nurse, and administrative support), decreasing the workload for veterinary clinical specialists. In addition, it would formalise the network of IVR's clinical specialists, facilitating the recruitment of patients. The committee considers this a high risk/high gain project. Such centres are notoriously difficult to set up, with potential risks including failure to recruit sufficient patients, personnel, or industrial partners. Having said that, the centre will contribute substantially to the viability of IVR if it is successful.

### *Interdisciplinarity*

IVR is strongly steering on interdisciplinary research, for instance by organising its research in a thematic fashion and by physically clustering research groups that work on the same theme (e.g., in the RMCU and a new One Health building). This seamlessly fits into the Utrecht Life Sciences strategy and it also aligns with the international trend towards interdisciplinary scientific research. Indeed, today's most pressing scientific and societal questions call for a multidisciplinary approach. In addition, theme-oriented research is a trend among young scientists. The committee therefore

applauds this strategy and encourages the institute to continue along this line. The FVM's plans to restructure the departmental organisation in 2020 and better align the departments with the three research themes is expected to add to the institute's viability by improving the coordination of research activities. In addition, this reorganisation may make the external communication and the administration of important figures much more straightforward.

#### *International collaborations*

IVR strongly focused on local collaborations during the review period, especially within Utrecht University's strategic theme Life Sciences. In addition, there have been ample collaborations with Wageningen University & Research and several other Dutch research institutes. However, international collaborations appear to have mostly been based on *ad hoc* collaborations of individual scientists rather than an underlying strategy of the FVM. Strengthening the institute's international collaborations is a key element of the Faculty's strategy for the period 2017-2021. The committee applauds this because international consortia are an increasingly important way of recruiting funding.

#### *Human resources*

The committee spoke with seven 'young talents' during the site visit. They were all associate professors. The committee learned that the FVM has improved the opportunities for career development in the last few years. For instance, the FVM launched the Vet2020 programme for organisational and leadership development. This programme aims to train leadership at a young stage, giving staff members more opportunities to fully exploit their insights and expertise. The committee encourages the institute to continue along this line. The 'young talents' expressed a need for clear guidelines on the path to a permanent position at IVR. It may indeed be beneficial to add some structure to the career prospects of talents. The institute had no tenure tracks in the period 2012-2017. At present, UU offers the opportunity to start a career track (which is similar to a tenure track) for talented researchers that wish to develop from associate to full professor. IVR may wish to investigate if some of its researchers could start such a career track. More broadly speaking, the committee thinks that there is still room for improvement in IVR's talent policy, for instance in stimulating talented and entrepreneurial PhD students. The committee was surprised to learn that some staff positions were difficult to fill, and believes this requires attention.

Another topic that arose multiple times during the site visit was the shortage of support staff in some research groups. Many research groups have only a limited number of principal investigators that have to supervise many junior researchers, as well as perform a plethora of management and education tasks. It would be more optimal if the institute could hire more postdocs (so the workload could be divided more) and/or support staff such as people that can assist in project management, human resources, and financial project management. In this context, the recent extension of IVR's Research Support was received very positively by the IVR scientists and the assessment committee.



## 7. Assessment PhD programme, research integrity policy, and diversity policy

### 7.1 PhD programme

During the evaluation period, the number of PhD students at IVR as a whole dropped from 175 in 2012 to 123 in 2017. The committee learned that this reduction was the result of a decrease in external funding (in the AVR, RMSCC, and RA programmes) as well as the recent strategy of the FVM to discourage spending intramural (i.e., UU) funding on the employment of PhD students.

#### *Selection and admission procedure*

The recruitment procedure for PhD students usually proceeds via a normal open call. Selection is performed by one or more principal investigators. PhD students on scholarships from countries such as China may be selected through a Skype interview. The committee thinks that it may be necessary to critically examine the selection procedure for PhD students because the drop-out percentage is very high in some IVR programmes; we will further discuss this below.

#### *Graduate School of Life Sciences*

All PhD students appointed at the FVM are enrolled in Utrecht University's Graduate School of Life Sciences (GSLs). This graduate school is the shared responsibility of Utrecht's Faculties of Veterinary Medicine, Medicine, and Science. This interfaculty nature promotes interactions of veterinary PhD students with students from the UMCU and the Faculty of Science. The GSLs organises training and education for Master's students and PhD candidates in the life sciences. With around 1750 PhD students, the GSLs is the largest graduate school in the Netherlands and perhaps the largest in Europe. The committee learned that the GSLs offers 14 PhD programmes. The veterinary PhD students are spread over these programmes, with the highest number of veterinary students in the Infection & Immunity programme (n=46), Toxicology & Environmental Health (n=29), Epidemiology (n=14), Regenerative Medicine (n=13), and Cancer, Stem Cells & Developmental Biology (n=10). (These numbers are based on data from 2016.)

The GSLs has a PhD Council consisting of one PhD representative for each of the 14 PhD programmes. The PhD Council constitutes the voice of the PhD candidates and aims to improve the quality of PhD- education and the regulations by raising issues and providing feedback on the propositions of the Executive Board of Studies. In addition, they organise an annual PhD day, regular PhD events, and other activities such as a survey on burn-outs among PhD students. The committee noticed that not all veterinary PhD students are aware of the existence of the PhD Council of the GSLs. At the Faculty level, there is a veterinary PhD Council, which consists of six veterinary PhD students. This Council meets every two months and organises social events.

#### *Quality assurance and supervision*

The GSLs dictates that PhD candidates and their supervisors complete a Training and Supervision Agreement (TSA) at the start of the PhD project. This agreement includes an education plan as well as the obligations and responsibilities of the PhD candidates and supervisors. The TSA imposes a 'go-no go' decision within the first year of the PhD track. As of January 2013, the TSA formally involves the appointment of one or more external PhD advisors at UU or elsewhere that monitor progress and

supervision of the PhD candidate. A PhD candidate that has fully met the requirements of the TSA will receive the GSLS Training Certificate at the time of graduation. In case of problems (e.g., between supervisor and PhD student), a PhD student may consult the external supervisor, the PhD Council of the GSLS, the coordinator of the PhD programme, a PhD confidant at the FVM, or the general (i.e., not specific for PhD students) confidant at the FVM.

In theory, the TSA safeguards the quality of training and supervision of PhD candidates. However, the committee learned that in practice, some PhD students receive substantially better guidance and training than others, depending on the attitude of supervisors and the culture within the research group. The students also reported that information about PhD facilities and requirements is somewhat scattered. In conclusion, the infrastructure to safeguard the PhD training seems in place, but the practical implementation of these measures leaves some room for improvement. The committee will provide recommendations on how to deal with this in section 8.2.

### *Courses*

PhD candidates enrolled in the GSLS are offered a 20-credits training programme<sup>2</sup>. The students should spend at least 40% of these credits on thematic courses of their own PhD programme. In addition, they should spend at least 20% on general courses. A maximum of 20% of the credits may be spent on symposia and conferences. The GSLS offers courses through an online PhD Course Center that was launched in 2015. The PhD Course Centre offers students the opportunity to shape their skills according to the PhD Competence Model. Course topics range from general research skills (e.g., statistics) to personal development, including communication (writing, pitching), personal effectiveness (time management, dealing with stress), responsible conduct of science, teaching, leadership & management, and career development. All courses can be attended for free or at low cost by the PhD candidates of the GSLS.

The committee is impressed by the broad educational programme that is offered to the PhD students and praises the fact that PhD students can also follow MSc courses offered by the GSLS. However, the committee was surprised to learn that there are no mandatory courses, while all students should be exposed to issues such as research integrity at the start of their PhD track. The committee will provide recommendations on how to deal with this in section 2.8. In addition, it should be noted that PhD students can graduate without having earned the GSLS certificate (i.e., without having completed the 20 ECTS training programme). Around 50% of GSLS students obtain their PhD without completing the 20 ECTS training programme. Although the committee considers 20 ECTS as a lot, it would be good to install some measures to ensure that every PhD student at the FVM receives a reasonable amount of training.

### *Success rate, duration, and exit numbers*

Many PhD students at IVR take quite long to graduate (in many cases more than five years). The long duration of PhD tracks is high on the agenda of the life sciences deans and a 'working group PhD track' is advising the deans on how to limit the duration of PhD tracks. The drop-out rate of PhD students is also rather high in some programmes. The committee was surprised to learn that IVR does not have proper insight in the reasons why some students terminate their PhD track. For

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<sup>2</sup> Credits are assigned according to the European Credit Transfer System (ECTS), where one credit = 28 hours.

instance, it is unclear whether these are students that decided to stop themselves or that were forced to quit at the go/no go point in the first year. In addition, the reasons for the long duration of many PhD tracks also seem to be rather obscure (although the committee did hear some potential reasons, including the interval between manuscript approval and formal examination, higher demands of scientific journals, and combining PhD training with clinical training). It will be hard to manage these problems if such information is unavailable.

#### *Career prospects and guidance to the job market*

The GSLS offers courses related to career development. In addition, there are courses that teach students the professional skills that are necessary to function effectively as an employee in both academic and non-academic settings. So, there is some infrastructure to guide PhD students to the job market. However, slightly more active guidance by supervisors may be warranted.

Around 95% of GSLS PhD students find a job within six months after graduation and around 70% continue their scientific careers as postdocs. At present, IVR does not register where its PhD students end up after graduation. The committee considers it important to keep track of the future careers of veterinary PhD students because this may help the institute improve the training of PhD candidates. In addition, it may attract talented aspiring PhD students to the institute.

## **7.2 Research integrity policy**

The assessment committee considered IVR's research integrity policy and the way in which violations of such integrity are prevented. Every employee at Utrecht University is required to comply with the Netherlands Code of Conduct for scientific practice, which includes topics such as scrupulousness, reliability, verifiability, impartiality, and independence. An updated version of this Code will be in place in 2018. In addition to these national guidelines, Utrecht University's 'Code of Conduct for Scrupulous Academic Practice and Integrity' describes key principles on how to achieve the open culture that UU desires. MSc and PhD students at Utrecht University are supposed to take note of the Checklist 'Eerlijke Wetenschap' (honest science). In addition, the GSLS offers several courses related to the responsible conduct of science (but none of these is mandatory). An academic integrity counsellor and a committee for academic integrity have been appointed by the university to look into complaints concerning academic integrity.

The committee did not encounter any integrity-related problems, nor would it have been able to detect these based on the information provided. The infrastructure to ensure research integrity is in place and the institute seems to be aware of its importance. Nevertheless, the committee thinks that it would be good to ensure that IVR employees are indeed aware of the university's attitude towards matters such as reliability, verifiability, impartiality, and independence. The committee will provide recommendations on how to approach this in section 8.3.

Modern life scientists produce large amounts of complex research data. As a result, adequate research data management (RDM) has become an indispensable aspect of the responsible conduct of science. Research Data Management Support is a multidisciplinary network of data experts within Utrecht University that offers UU scientists the RDM training, tools, infrastructure, guidance, and support. The university prescribes that data and other documentation that constitute the basis of

scientific publications must be archived for at least ten years, according to Good Archiving Practices. The University Library offers services that enable scientists to share their research data in publicly accessible repositories. In this way, the data can be easily be found, reused, and cited, thus increasing the impact of the work.

### **7.3 Diversity and inclusiveness policy**

The FVM has explicitly incorporated diversity as an important theme in its Strategic Plan 2017-2021: *'The Faculty is committed to creating equal opportunities for all and a culture in which people with a diversity in talents feel at home and are able to excel'*. They aim for a balanced gender ratio, from the junior through the senior scientist level. In addition, they would like to attract more international employees and students, as well as people from varying cultural backgrounds.

#### *Gender diversity*

During the evaluation period, the FVM has actively strived to increase the number of female staff members. This was done through awareness programmes for management and research staff, coaching for young female scientific staff, and active promotion and recruitment of female professors. These efforts have resulted in a substantial increase in the number of female professors, with 29% of the chairs filled by female professors in 2018. This is to be applauded. However, the IVR Research Council (i.e., the six theme leaders) currently has only one female member. In addition, the representation of females among programme coordinators and group leaders was also low in the period 2012-2017:

- AVR: female coordinator; 3 out of 4 group leaders were female,
- F&R: male coordinator; 0 out of 3 group leaders was female,
- B&W: male coordinator; 1 out of 3 group leaders was female<sup>3</sup>,
- RMSCC: male coordinator; 2 out of 11 group leaders were female,
- I&I: male coordinator; 1 out of 8 group leaders was female,
- RA: male coordinator; 0 out of 4 group leaders were female.

#### *International employees*

The percentage of international staff members was approximately 15% during the evaluation period and 38% of the PhD students come from abroad. The FVM has launched policy measures to increase the number of international staff members. They perform international searches to fill vacancies and there is a hospitality programme for international guests and employees. In addition, scientists that obtain a permanent position at the FVM should have spent a considerable part of their careers abroad. Recently, Utrecht University and the local government established an international school (ISUtrecht) to foster the acquisition of international talent. The committee noticed that many permanent staff members have worked at IVR for a large proportion of their career. Indeed, the IVR management described IVR as a 'close community' (*'We train our future leaders'*). This should be examined critically because it makes the institute less attractive to people from abroad.

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<sup>3</sup> To be more precise, the B&W programme had six coordinators over the review period, two of which were female. The female programme coordinator (Professor Frauke Ohl) passed away in 2016.

## 8. Recommendations

### 8.1 Quality of the research unit

#### 1. Safeguard the veterinary identity of IVR research.

IVR seems to increasingly shift its scientific attention to research to the benefit of human health and healthcare. This 'human work' is of excellent scientific quality and high societal relevance. In addition, it seamlessly fits into the priorities of Utrecht University (amongst others the strategic theme 'Life Sciences'). Some IVR research groups successfully combine animal and human-oriented work in their studies (e.g., the groups of Professor Marianna Tryfonidou in the RMSCC programme and Professor Dick Heederik in the Risk Assessment programme). Other research groups seem to merely use animals as model organisms to study human health and disease, or at least they present their research in that way in order to increase their chances of getting funded.

Being the only veterinary faculty in the Netherlands, it is crucial that IVR fosters its veterinary identity and maintains a strong focus on animal health and healthcare. The committee acknowledges that it is substantially easier to attract funding for research that benefits human health. However, as mentioned in section 6.2, IVR may find that there are additional opportunities to obtain funding for animal-oriented work if it could better align its research priorities with stakeholders' needs, without sacrificing its scientific autonomy. The committee applauds the institute's recent attention to the opportunities offered by fourth money flow. IVR has appointed a dedicated staff member at the Research Support Office that will assist IVR scientists in fund raising from charities, private funds, legacies, and crowd-funding. The committee considers this a promising avenue to increase funding for research with a veterinary focus. In addition, the FVM should take a variety of other measures to safeguard the veterinary identity of its research; these are discussed below (recommendations 2-6).

#### 2. Strategically collaborate with peripheral clinics.

The FVM should devise a strategy on how to position itself with respect to the peripheral veterinary specialist clinics that have recently appeared in the Netherlands. The FVM Academic Veterinary Hospital is crucial to the veterinary identity of IVR research, but is experiencing difficulties in recruiting and retaining veterinary clinical specialists. This is the result of competition from the peripheral veterinary specialist clinics and the increasing focus on farm animal health of Wageningen University & Research (WUR). The peripheral clinics and the WUR compete with the FVM for high-quality specialists and scientists. In the case of WUR, IVR has approached this challenge by starting numerous collaborations. This has proven a very fruitful strategy. The committee suggests to approach the peripheral clinics in a similar way, i.e., steer on collaboration.

#### 3. Ensure that veterinary clinical specialists have sufficient time for research.

The committee considers it crucial that veterinary clinical specialists are given sufficient time for research. This will improve the quality of IVR research, especially within the Veterinary Biomedicine theme. It will also promote interactions between basic and clinical scientists. Importantly, it may offer part of a solution to the institute's problems in recruiting and retaining veterinary specialists. This is because the opportunity to advance the specialist field through research constitutes the

faculty's unique selling point compared to peripheral clinics. The committee urges the faculty to ensure that veterinary clinical specialists have sufficient time for research. Possible avenues include appointing more support staff, organising care more efficiently, delegating work to others by collaborating with peripheral clinics, and having veterinary clinical specialists focus on either education or research.

**4. Transform the Veterinary Biomedicine theme into more than a collection of programmes.**

The committee appreciates the efforts towards strengthening the AVR, F&R, and B&W programmes by launching the overarching Veterinary Biomedicine theme. However, it is now crucial to truly build one team and seek for focus and synergy. The IVR management should truly foster and support this theme as it constitutes the veterinary identity of the institute.

**5. Keep ensuring interaction between basic and clinical scientists within the RMSCC theme.**

The committee expects that it will be difficult to ensure lasting collaborations between basic and clinical scientists after the move of RMSCC's basic scientists to the RMCU building. The theme coordinators are keenly aware of this threat and have developed an interaction plan to ensure lasting scientific collaborations between basic and clinical scientists. The committee encourages the theme to continue along this line and continuously monitor if basic and clinical scientists are sufficiently interacting.

**6. Critically monitor the balance between animal and human work within the One Health theme.**

It will be important to continuously monitor the balance between animal and human-oriented research in the One Health theme. It may be tempting to 'follow the easy money' and increasingly shift to research to the benefit of human health and healthcare. However, as mentioned several times, the committee thinks that there should be sufficient opportunities to fund animal-oriented research as well. (Please note that the committee does **not** recommend decreasing the amount of human-oriented research, as this constitutes excellent science. Rather, the theme should ensure that it fosters animal-oriented work as well.)

**7. Devise a strong branding & communication strategy.**

IVR research clearly has a strong positive impact on society, but this is not always evident to its stakeholders. Somehow, the institute's achievements and expertise often get lost in translation and its visibility is not optimal. In addition, its research priorities do not always align with stakeholders' needs. In its Strategic Plan 2017-2021, the FVM states that it wants to position itself as a veterinary knowledge centre, for example by organising internal and external debates. They wish to act as a network organisation, strongly interacting with partners in veterinary fields. The committee encourages IVR to seriously invest in these plans and work on a strong branding & communication strategy. This strategy should focus on what the institute can offer its stakeholders (e.g., expertise, facilities), tailored to specific target groups. It should also make clear what the institute does *not* to offer (i.e., its strategic choices). Communication should not only take the form of broadcasting information, but also be an interactive dialogue with the stakeholders.

**8. Optimise human resources management to ensure that employees can excel.**

The committee suggests several improvements related to human resources management:

- Although the FVM has worked on the opportunities for career development in recent years, there still is room for improvement. The most important HRM action would be to decrease the workload of veterinary clinical specialists, as already discussed in recommendation 3. In addition, the FVM may provide more support to entrepreneurial PhD students and other young talents.
- The ratio between academic staff and support staff at IVR appears to be suboptimal. It would be good if the institute could hire more support staff such as people that can assist in project management, human resources, and financial project management.
- To make the institute more attractive for talented young scientists, it would be good to establish clear guidelines on the road towards a permanent position at IVR, possibly by launching a tenure track programme.
- It would be good to devise a strategy to compensate for the expected departure of senior staff members well in advance. The institute may even want to consider changing leadership in anticipation of retirement, to prevent a leadership vacuum in a group.

#### **9. Install an external scientific advisory board for each of the three themes.**

At present, IVR does not have an external scientific advisory board, so the committee recommends installing one for each theme. Ideally, these boards should consist of both scientists and societal stakeholders (from veterinary practice, industry, and the government). The boards should meet to review progress and provide input, for instance once a year. They could help IVR to identify new opportunities and areas for development. This will help IVR to stay at the forefront of their field by proactively seizing opportunities and embracing technological, scientific, and societal changes quickly.

#### **10. Adopt a more systematic approach to international collaboration.**

IVR's international collaborations appear to have mostly been based on collaborations of individual scientists rather than an overarching strategy of the FVM. The committee recommends to approach this in a more systematic way, at the level of the Faculty. The committee thus applauds the fact that international collaboration is a key element of the Faculty's strategy for the period 2017-2021.

### **8.2 PhD programme**

#### **1. Critically revisit the selection procedure for PhD students.**

It may be necessary to install more stringent admission rules for PhD students because the drop-out percentage is high in some IVR programmes. However, IVR should first examine the reasons why PhD students drop out of the PhD programme (see recommendation 3 below).

#### **2. Install a mandatory introduction course at the GSLS or FVM level.**

The committee recommends organising a mandatory introduction course for PhD students around four times a year. This course should address research integrity and the responsible conduct of science. In addition, it should provide an overview of what is offered by the GSLS, who to approach in case of problems, and other aspects such as the presence of a PhD Council and the technological facilities at Utrecht Life Sciences. Such a course will help the students to find their way at the campus and it will bring together the somewhat scattered information.

**3. Strive for more standardisation in the supervision and training of PhD students and keep a better administration of relevant figures related to PhD students.**

As described in the section 7.1, the practical implementation of measures to safeguard the quality of PhD supervision training leaves room for improvement. There is substantial variation in the amount of supervision and training that the PhD candidates receive. Students can graduate without having earned the GSLS certificate. It would be good to install some measures that ensure that every PhD student at IVR receives proper supervision and training. In addition, to improve the quality of PhD training at the institute, it is important to obtain insight in:

- the reasons why many PhD candidates at IVR take longer than five years to graduate,
- what percentage of time PhD students actually spend on research, for instance in case of residents that combine PhD research with clinical specialisation,
- what are the success rates and the durations for residents that combine their specialisation with PhD graduation (both for obtaining the title of specialist and the PhD),
- why some students drop out of the PhD programme: is this the decision of the supervisor or of the student,
- the career development of the PhD graduates.

**4. Establish clear guidelines on the minimal requirements for PhD graduation.**

There do not seem to be clear rules on the number of manuscripts and other minimum requirements for PhD graduation. It would be good to develop minimal standards and to communicate these clearly to the PhD candidates.

**5. Provide more guidance to the job market.**

Supervisors may devote more attention to guiding PhD students to the job market. Perhaps the students themselves could organise a career day, where former IVR PhD students give information about their career path.

### **8.3 Research integrity**

**1. Install a mandatory primer or seminar on research integrity at the GSLS or FVM level.**

All PhD students (and preferably all employees) should be exposed to Utrecht University's attitude towards research integrity issues. It would therefore be good to include this as a topic in a mandatory introduction course or to launch a seminar on this topic.

### **8.4 Diversity and inclusiveness**

**1. Strive for more diversity in terms of gender, nationality, and background.**

The committee acknowledges that the FVM is seriously devoting attention to the topic of diversity and strongly encourages the management to continue along this line. The percentage of female staff members at the level of group leaders and theme coordinators can substantially be increased. The committee also thinks that the number of international staff members (approximately 15%) is quite low, so this should be improved.



## **Appendix 1.** Short CVs of the members of the assessment committee

### **Leo den Hartog** (chairman)

Leo den Hartog is an Extraordinary Professor of Animal Nutrition in a Circular Economy at Wageningen University (the Netherlands). In addition, he is Director R&D at Nutreco, which is one of world's largest feed concerns, with research centres for ruminants, pigs, poultry, fish, ingredients, and food in Europe, North-America, and Asia. Den Hartog obtained his MSc (1978, in Animal Science) and his PhD (1984, on the relationship between nutrition and fertility in gilts and sows) from Wageningen University. In 1989, he received the Henneberg Lehmann Award from the University of Göttingen (Germany). In 1999, he accepted an honorary PhD from the University of Kaposvar (Hungary). In 2014, he was given the Molenaar Award from the Animal Nutrition magazine in the Netherlands and Belgium for his ongoing efforts to promote cooperation between science, governance, business, and farmers. Den Hartog's extensive experience in animal production is reflected in over 450 scientific and applied articles and seven books as author or co-author. To date, he has given more than 600 lectures in over 35 different countries. He has also been chairman of Dutch trade missions on behalf of the Ministry of Agriculture, Nature & Food Quality to China, Taiwan, South Korea, Brazil, Argentina, Chile and South Africa.

### **Gerald de Haan**

Gerald de Haan is a Professor of Molecular Stem Cell Biology at the University Medical Centre Groningen (UMCG) in the Netherlands. In addition, he has been the Scientific Director of the European Research Institute for the Biology of Ageing (ERIBA) since October 2016. His research group studies mechanisms that specify normal stem cell functioning. They focus on hematopoietic stem cells and are interested in the unique genetic and epigenetic programme that distinguishes stem cells from non-stem cells. De Haan received his MSc (1990) and PhD (1995) from the University of Groningen. As a graduate student, he was employed by the University of Cologne, working on the regulation of blood cell production by growth factors. He became a postdoc at the University of Kentucky, where he worked on stem cell aging. De Haan returned to the Netherlands as a KNAW fellow. He established his own lab at the Department of Cell Biology of the UMCG, where he was appointed full professor in 2005. He was awarded a VICI grant by NWO in 2007. He was dean of the Learning Community Molecular Medicine (2013-2017) and member of the Medical Research Council UK Molecular and Cellular Medicine Board (2013-2018). He currently is a member of the Scientific Advisory Board of InnoSer (since 2013), treasurer at the Dutch Society for Stem Cell Research (since 2009), board member of Nature Regenerative Medicine (since 2016), member of the editorial board of Hematology/BLOOD (since 2015), and member of the ZonMw committee 'Programma Translationeel Onderzoek' (since April 2018).

### **Sylvie Daminet**

Sylvie Daminet is a full professor at the Department of Small Animals of the Faculty of Veterinary Medicine at Ghent University (Belgium). She graduated from the University of Liège (Belgium) in 1992. Next, she performed an internship and a residency in Internal Medicine at the University of Montreal (Canada). In 1996, she became a diplomate of the American College of Veterinary Internal Medicine (ACVIM) and the European College of Veterinary Internal Medicine (ECVIM). Daminet obtained a Master's degree over canine thyroid function tests from the University of Montreal. She

was an assistant professor at the universities of Montreal and Prince Edward Island in Canada and at the Royal Veterinary College in London in England. In 2002, Daminet obtained her PhD on thyroid function tests in dogs at the University of Ghent. Currently, she is responsible for the small animal internal medicine section at Ghent University. Her clinical and research interest are in endocrinology and nephrology. Daminet authored or co-authored over 150 publications in international and national journals. She was President of the European Society of Veterinary Endocrinology (2009-2011) and Head of the Specialty of Internal Medicine of ECVIM (2011-2014).

### **Per Jensen**

Per Jensen is a professor at the Department of Physics, Chemistry, and Biology of Linköping University (Sweden). He is the scientific leader of the AVIAN group, which aims to find genes and genetic mechanisms related to welfare and domestication. Chickens and dogs are his main model species. His research group keeps two different populations of red junglefowl (a model laying strain) and various crosses between these animals. Jensen collaborates with the Swedish Defence Forces to study their dog breeding programme. He also uses companion dogs and the standardised behaviour tests common in Sweden. This is combined with molecular methods such as QTL analysis and microarray techniques to find the genetic basis for various behaviours affected by domestication, such as social behaviour, learning, and stress reactions. Jensen has a particular interest in epigenetic aspects and transgenerational effects of stress. Hence, his research also deals with stress biology and the long-term effects of perinatal experiences.

### **Erika Von Mutius**

Erika von Mutius is a professor of Paediatrics at Ludwig-Maximilians-University in Munich (Germany). She heads the Asthma and Allergy Department of the Dr. von Hauner Children's Hospital of the University of Munich and the Institute for Asthma and Allergy Prevention at Helmholtz Zentrum München. She is interested in the epidemiology of paediatric respiratory diseases and allergy. Her research group has been actively involved in design, implementation and data analysis of many large, Pan-European multi-centre and interdisciplinary projects, including birth cohort studies, addressing the role of genetic and environmental, particularly microbial factors for the development of asthma and allergic diseases. Von Mutius completed her internship and residency training in the Department of General Paediatrics, Neonatal and Paediatric Intensive Care at this hospital. From 1992-1993, she was a research fellow at the Respiratory Sciences Center at the University of Arizona (Tucson, USA) and also received training in Clinical Effectiveness at Harvard School of Public Health in Boston (USA) earning a Master in Epidemiology degree. In 2004, she became Professor of Paediatrics at Ludwig-Maximilians-Universität and in 2017, she became Head of the Institute for Asthma and Allergy Prevention at Helmholtz Zentrum München. Von Mutius has received several prestigious awards, serves on various international committees, and is an active editorial board member of the New England Journal of Medicine.

### **Bernd Kaspers**

Bernd Kaspers has been a Professor in Animal Physiology at the Faculty of Veterinary Medicine of the University of Munich (Germany) since 1997. His work involves research on the innate and adaptive immune system in birds, with a focus on host-pathogen interaction, immune system maturation, and mucosal immunity. He has developed a broad range of tools for avian immunology research, including CD-markers, recombinant cytokines, bio-assays, and technologies for functional *in vivo*

studies, which have been made available to the international avian research community. Kaspers graduated in Veterinary Medicine from the University of Munich in 1986 and received his Dr of Veterinary Medicine degree in 1989. In 1991 and 1992, he worked as a postdoctoral fellow at the United States Department of Agriculture in Beltsville, MD where he studied the immune response to coccidiosis before returning to Munich. He has more than 30 years of research experience in avian physiology and immunology, which is documented by more than 100 peer-reviewed publications. He is co-editor of 'Avian Immunology', published in a 2nd edition in 2014. He is actively involved in the Avian Immunology Research Group (AIRG). Kaspers received funding from the European Union, the German Research Foundation (DFG) and the German Ministry for Education and Research. He also coordinated a DFG funded Graduate School at the Faculty of Veterinary Medicine in Munich.

### **Linda van den Berg**

Linda van den Berg is an independent science writer and communications consultant with a background in the life sciences. She obtained a MSc (fundamental biomedical sciences, *cum laude*) in 2000 and a PhD (behavioural genetics) in 2006, both from Utrecht University (the Netherlands). In the period 2006-2012, she was a Postdoctoral Researcher at VU University Medical Center (the Netherlands), the Broad Institute of Harvard and MIT (USA), and Leiden University Medical Center (the Netherlands). Since 2012, she has worked as a professional science writer, with a special interest in research quality and science & society. Her company Washoe Life Science Communications offers a variety of communication services to academic institutes, patient organisations, and companies. Since 2015, she has served as an independent secretary to several research assessment committees.

## Appendix 2. IVR site visit programme

| <b>Sunday 7 October 2018</b> |  |
|------------------------------|--|
| 17.30                        | Welcome reception with Dean, Vice-Dean, Program Coordinators |
| 18.30                        | Dinner (committee only)                                      |

| <b>Monday 8 October 2018</b> |   |
|------------------------------|---|
| 8:30                         | <i>Transport by taxi from hotel Mary K to Faculty of Veterinary Medicine (FVM)</i>  |
| 09:00                        | Short welcome by the Dean + vice Dean<br>Committee meeting (review aims & procedures, first impressions, preliminary assessments, preparing the interviews) |
| 11:00                        | Meeting with the IVR management (presentation and interview about Institute part of self-assessment and plans for the future)                               |
| 12:00                        | <i>Lunch</i>  |
| 13:00                        | Research Theme Veterinary Biomedicine<br><i>research programmes F&amp;R, B&amp;W, AVR</i>   |
| 15:00                        | <i>Wrap up Veterinary Biomedicine</i>   |
| 15:30                        | Tour of facilities  |
| 17:30                        | <i>Evaluation of the first day</i>  |
| 18:30                        | <i>Transport by taxi from FVM to restaurant</i>   |
| 19:00                        | Dinner with the Dean, the IVR management, IVR Research Council, Program Coordinators  |

| <b>Tuesday 9 October 2018</b> |   |
|-------------------------------|---|
| 08:30                         | <i>Transport by taxi from hotel Mary K to FVM</i> |
| 09:00                         | Research Theme Regenerative Medicine & Cancer     |
| 10:30                         | <i>Wrap up RMSC</i>                               |
| 11:00                         | Meeting with Graduate School of Life Sciences     |
| 12:00                         | Lunch – <i>with PhD-candidates</i>                |
| 13:00                         | One Health<br><i>Research program I&amp;I</i>     |
| 14:30                         | <i>Wrap up OH</i>                                 |
| 15:00                         | Young talent session                              |
| 16:00                         | <i>Break</i>                                      |
| 16:30                         | Meeting with societal stakeholders                |
| 17:30                         | <i>Transport by taxi from FVM to hotel Mary K</i> |
| 19:00                         | Dinner (committee only)                           |

| <b>Wednesday 10 October 2018</b> |   |
|----------------------------------|---|
| 08:30                            | <i>Transport by taxi from hotel Mary K to FVM</i> |
| 09:00                            | One Health<br><i>Research programme RA</i>        |
| 10:30                            | <i>Wrap up OH</i>                                 |

|       |   |
|-------|---|
| 11:00 | Committee meeting (conclusions & tasks; IVR management available on demand)<br><i>Including lunch</i> |
| 13:00 | First report to the Dean, the IVR management, IVR Research Council, Program<br>Coordinators           |
| 14:00 | End of proceedings  |

### Appendix 3. Quantitative data on IVR's composition and financing

**Table 1.1:** Research staff at IVR as a whole in the period 2012-2017

| IVR                            | 2012       |              | 2013       |              | 2014       |              | 2015       |              | 2016       |              | 2017       |              |
|--------------------------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|
|                                | #          | FTE          | #          | FTE          | #          | FTE          | #          | FTE          | #          | FTE          | #          | FTE          |
| Scientific staff <sup>1</sup>  | 236        | 87,3         | 233        | 85,5         | 237        | 84,9         | 221        | 93,9         | 224        | 89,1         | 212        | 86,3         |
| Post-docs <sup>2</sup>         | 48         | 31,4         | 53         | 32,4         | 56         | 38,5         | 39         | 26,7         | 47         | 28,5         | 46         | 29,1         |
| PhD students <sup>3</sup>      | 175        | 128,7        | 151        | 113,2        | 137        | 105,0        | 123        | 92,7         | 126        | 94,9         | 123        | 98,3         |
| SIO <sup>4</sup>               | 14         | 4,0          | 15         | 2,4          | 34         | 4,4          | 10         | 3,5          | 44         | 5,2          | 44         | 5,0          |
| <b>Total research staff</b>    | <b>473</b> | <b>251,3</b> | <b>452</b> | <b>233,6</b> | <b>464</b> | <b>232,8</b> | <b>393</b> | <b>216,8</b> | <b>441</b> | <b>217,7</b> | <b>425</b> | <b>218,7</b> |
| Support staff/visiting fellows | n.d.       | n.d.         | n.d.       | n.d.         | n.d.       | n.d.         | 120        | 64,6         | 96         | 64,2         | 93         | 56,8         |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category 'Onderzoeker' ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.

Scientific staff spent on average about 40% of its time on research. The average research time of postdocs and PhD students was 80-95%, compliant with grant requirements. Residents dedicated about 13% of their time to research.

**Table 1.2:** Research staff of the AVR programme in the period 2012-2017

| Applied Veterinary Research    | 2012       |             | 2013       |             | 2014       |             | 2015        |             | 2016         |             | 2017         |             |
|--------------------------------|------------|-------------|------------|-------------|------------|-------------|-------------|-------------|--------------|-------------|--------------|-------------|
|                                | #          | FTE         | #          | FTE         | #          | FTE         | #           | FTE         | #            | FTE         | #            | FTE         |
| Scientific staff <sup>1</sup>  | 82         | 13,3        | 82         | 12,3        | 85         | 16,0        | 66          | 13,2        | 68           | 13,9        | 74           | 15,3        |
| Post-docs <sup>2</sup>         | 7          | 1,2         | 7          | 2,0         | 14         | 3,1         | 0           | 0,0         | 1            | 1,0         | 1            | 1,0         |
| PhD students <sup>3</sup>      | 26         | 15,8        | 21         | 11,8        | 19         | 7,6         | 4           | 1,4         | 4            | 2,3         | 5            | 3,5         |
| SIO <sup>4</sup>               | 13         | 3,0         | 13         | 1,3         | 30         | 3,7         | 10          | 3,5         | 40           | 3,9         | 41           | 3,7         |
| <b>Total research staff</b>    | <b>128</b> | <b>33,2</b> | <b>123</b> | <b>27,4</b> | <b>148</b> | <b>30,4</b> | <b>80,0</b> | <b>18,2</b> | <b>113,0</b> | <b>21,1</b> | <b>121,0</b> | <b>23,6</b> |
| Support staff/visiting fellows | n.d.       | n.d.        | n.d.       | n.d.        | n.d.       | n.d.        | 41          | 6,3         | 18           | 2,21        | 20           | 2,58        |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category Onderzoeker ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.

Note that 2 groups left after 2014

**Table 1.3:** Research staff of the F&R programme in the period 2012-2017

| Fertility & Reproduction       | 2012      |            | 2013      |             | 2014      |             | 2015      |             | 2016      |             | 2017      |             |
|--------------------------------|-----------|------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
|                                | #         | FTE        | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         |
| Scientific staff <sup>1</sup>  | 12        | 4,5        | 11        | 4,4         | 12        | 4,9         | 13        | 6,4         | 12        | 5,8         | 11        | 5,0         |
| Post-docs <sup>2</sup>         | 2         | 1,7        | 3         | 2,0         | 4         | 3,0         | 1         | 1,0         | 2         | 1,1         | 2         | 1,2         |
| PhD students <sup>3</sup>      | 4         | 2,5        | 5         | 2,7         | 5         | 4,9         | 3         | 3,0         | 5         | 4,2         | 5         | 4,3         |
| SIO <sup>4</sup>               | 1         | 1,0        | 1         | 1,0         | 1         | 0,1         | 0         | 0,0         | 0         | 0,0         | 0         | 0,0         |
| <b>Total research staff</b>    | <b>19</b> | <b>9,6</b> | <b>20</b> | <b>10,0</b> | <b>22</b> | <b>12,9</b> | <b>17</b> | <b>10,4</b> | <b>19</b> | <b>11,1</b> | <b>18</b> | <b>10,5</b> |
| Support staff/visiting fellows | n.d.      | n.d.       | n.d.      | n.d.        | n.d.      | n.d.        | 2         | 2           | 12        | 7,4         | 13        | 7,62        |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category Onderzoeker ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.

**Table 1.4:** Research staff of the B&W programme in the period 2012-2017

| Behaviour & Welfare            | 2012      |             | 2013      |             | 2014      |             | 2015      |             | 2016      |             | 2017      |             |
|--------------------------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
|                                | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         |
| Scientific staff <sup>1</sup>  | 7         | 3,4         | 12        | 5,0         | 12        | 5,6         | 14        | 6,9         | 17        | 8,1         | 13        | 6,7         |
| Post-docs <sup>2</sup>         | 4         | 2,4         | 4         | 1,2         | 2         | 1,8         | 2         | 1,5         | 2         | 1,5         | 2         | 1,2         |
| PhD students <sup>3</sup>      | 8         | 7,2         | 9         | 6,0         | 5         | 4,2         | 7         | 5,1         | 8         | 5,8         | 7         | 6,2         |
| SIO <sup>4</sup>               | -         | -           | -         | -           | -         | -           | -         | -           | -         | -           | -         | -           |
| <b>Total research staff</b>    | <b>19</b> | <b>12,9</b> | <b>25</b> | <b>12,2</b> | <b>19</b> | <b>11,6</b> | <b>23</b> | <b>13,5</b> | <b>27</b> | <b>15,4</b> | <b>22</b> | <b>14,0</b> |
| Support staff/visiting fellows | n.d.      | n.d.        | n.d.      | n.d.        | n.d.      | n.d.        | 4         | 3,3         | 5         | 3,8         | 5         | 4           |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category Onderzoeker ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.

**Table 1.5:** Research staff of the RMSCC programme in the period 2012-2017

| Regenerative Medicine, Stem Cells and Cancer | 2012      |             | 2013      |             | 2014      |             | 2015      |             | 2016      |             | 2017      |             |
|--|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
|  | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         |
| Scientific staff <sup>1</sup>                | 33        | 11,8        | 33        | 12,5        | 35        | 11,4        | 28        | 13,3        | 29        | 12,4        | 30        | 13,6        |
| Post-docs <sup>2</sup>                       | 7         | 5,2         | 5         | 3,9         | 4         | 3,02        | 1         | 1,0         | 3         | 1,8         | 3         | 2,01        |
| PhD students <sup>3</sup>                    | 28        | 19,3        | 19        | 13,5        | 21        | 13,4        | 19        | 12,0        | 17        | 14,3        | 18        | 15,2        |
| SIO <sup>4</sup>                             | -         | -           | 1         | 0,2         | 3         | 0,6         | 2         | 1,15        | 4         | 0,9         | 3         | 1,3         |
| <b>Total research staff</b>                  | <b>68</b> | <b>36,3</b> | <b>58</b> | <b>30,1</b> | <b>63</b> | <b>28,5</b> | <b>50</b> | <b>27,5</b> | <b>53</b> | <b>29,4</b> | <b>54</b> | <b>32,1</b> |
| Support staff/visiting fellows               | n.d.      | n.d.        | n.d.      | n.d.        | n.d.      | n.d.        | 14        | 7,6         | 17        | 9,5         | 15        | 8,3         |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category Onderzoeker ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.

**Table 1.6:** Research staff of the I&I programme in the period 2012-2017

| Infection & Immunity           | 2012       |             | 2013       |             | 2014       |             | 2015       |             | 2016       |             | 2017       |             |
|--------------------------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
|                                | #          | FTE         | #          | FTE         | #          | FTE         | #          | FTE         | #          | FTE         | #          | FTE         |
| Scientific staff <sup>1</sup>  | 43         | 22,3        | 44         | 23,6        | 44         | 23,2        | 53         | 25,5        | 59         | 25,8        | 53         | 28,3        |
| Post-docs <sup>2</sup>         | 22         | 16,2        | 27         | 18,9        | 23         | 20,4        | 27         | 20,0        | 27         | 17,8        | 23         | 15,6        |
| PhD students <sup>3</sup>      | 50         | 37,7        | 44         | 38,3        | 48         | 40,4        | 51         | 41,4        | 59         | 42,7        | 62         | 46,6        |
| SIO <sup>4</sup>               | -          | -           | -          | -           | -          | -           | 1          | 0,2         | 2          | 0,4         | 2          | 0,4         |
| <b>Total research staff</b>    | <b>115</b> | <b>76,1</b> | <b>115</b> | <b>80,8</b> | <b>115</b> | <b>84,0</b> | <b>132</b> | <b>85,1</b> | <b>147</b> | <b>86,7</b> | <b>140</b> | <b>90,9</b> |
| Support staff/visiting fellows | n.d.       | n.d.        | n.d.       | n.d.        | n.d.       | n.d.        | 32         | 24,49       | 29         | 20,45       | 33         | 19,35       |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category Onderzoeker ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.

**Table 1.7:** Research staff of the RA programme in the period 2012-2017

| Risk Assessment                | 2012       |             | 2013       |             | 2014      |             | 2015      |             | 2016      |             | 2017      |             |
|--------------------------------|------------|-------------|------------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
|                                | #          | FTE         | #          | FTE         | #         | FTE         | #         | FTE         | #         | FTE         | #         | FTE         |
| Scientific staff <sup>1</sup>  | 59         | 32,2        | 51         | 27,8        | 49        | 23,8        | 47        | 28,5        | 39        | 23,1        | 31        | 17,4        |
| Post-docs <sup>2</sup>         | 6          | 4,7         | 7          | 4,4         | 9         | 7,2         | 8         | 3,3         | 12        | 5,3         | 15        | 8,8         |
| PhD students <sup>3</sup>      | 59         | 46,3        | 53         | 40,8        | 39        | 34,5        | 39        | 29,7        | 33        | 25,7        | 29        | 22,5        |
| SIO <sup>4</sup>               | -          | -           | -          | -           | -         | -           | -         | -           | -         | -           | -         | -           |
| <b>Total research staff</b>    | <b>124</b> | <b>83,2</b> | <b>111</b> | <b>73,1</b> | <b>97</b> | <b>65,5</b> | <b>94</b> | <b>61,5</b> | <b>84</b> | <b>54,1</b> | <b>75</b> | <b>48,7</b> |
| Support staff/visiting fellows | n.d.       | n.d.        | n.d.       | n.d.        | n.d.      | n.d.        | 28        | 20,9        | 27        | 20,8        | 20        | 14,7        |

Note 1: Comparable with WOPI categories HGL, UHD and (jr) UD; tenured and non-tenured staff.

Note 2: Comparable with WOPI category Onderzoeker ('universitair docent, tijdelijk').

Note 3: Standard PhD (employed) and Contract PhDs (externally or internally funded but not employed).

Note 4: Specialist in training, Residents.



**Table 2.1: IVR funding and expenditure in the period 2012-2017**

| IVR                             | 2012         |             | 2013         |             | 2014         |             | 2015         |             | 2016         |             | 2017         |             |
|---------------------------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
|                                 | FTE          | %           | FTE          | %           | FTE          | %           | FTE          | %           | FTE          | %           | FTE          | %           |
| <i>Funding:</i>                 |              |             |              |             |              |             |              |             |              |             |              |             |
| Direct funding IVR <sup>1</sup> | 109,8        | 44%         | 96,5         | 41%         | 88,2         | 38%         | 89,3         | 42%         | 91,8         | 42%         | 97,3         | 45%         |
| Research grants <sup>2</sup>    | 32,2         | 13%         | 35,2         | 15%         | 32,8         | 14%         | 27,4         | 13%         | 27,9         | 13%         | 30,8         | 14%         |
| Contract research <sup>3</sup>  | 109,3        | 44%         | 101,9        | 44%         | 111,7        | 48%         | 98,2         | 46%         | 98,0         | 45%         | 86,4         | 40%         |
| Other <sup>4</sup>              | -            | -           | -            | -           | -            | -           | -            | -           | -            | -           | -            | -           |
| <b>Total funding</b>            | <b>251,3</b> | <b>100%</b> | <b>233,6</b> | <b>100%</b> | <b>232,7</b> | <b>100%</b> | <b>214,9</b> | <b>100%</b> | <b>217,7</b> | <b>100%</b> | <b>214,5</b> | <b>100%</b> |
| <i>Expenditure:</i>             |              |             |              |             |              |             |              |             |              |             |              |             |
|                                 | M€           | %           | M€           | %           | M€           | %           | M€           | %           | M€           | %           | M€           | %           |
| Personnel costs <sup>5</sup>    | 13,8         | 46%         | 13,4         | 44%         | 13,4         | 44%         | 13,1         | 45%         | 13,5         | 49%         | 13,7         | 59%         |
| Other costs <sup>6</sup>        | 16,3         | 54%         | 17,3         | 56%         | 17,3         | 56%         | 16,2         | 55%         | 14,1         | 51%         | 9,7          | 41%         |
| <b>Total expenditure</b>        | <b>30,0</b>  | <b>100%</b> | <b>30,7</b>  | <b>100%</b> | <b>30,7</b>  | <b>100%</b> | <b>29,3</b>  | <b>100%</b> | <b>27,6</b>  | <b>100%</b> | <b>23,4</b>  | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering/ lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organisations and charitable organisations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW)

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead

**Table 2.2: Funding and expenditure of the AVR programme in the period 2012-2017**

| AVR                             | 2012        |             | 2013        |             | 2014        |             | 2015        |             | 2016        |             | 2017        |             |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                 | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           |
| <i>Funding:</i>                 |             |             |             |             |             |             |             |             |             |             |             |             |
| Direct funding IVR <sup>1</sup> | 22,9        | 69%         | 17,4        | 64%         | 22,1        | 73%         | 15,6        | 86%         | 18,7        | 89%         | 20,6        | 87%         |
| Research grants <sup>2</sup>    | 2,1         | 6%          | 1,9         | 7%          | 1,5         | 5%          | 0,2         | 1%          | 0,4         | 2%          | 0,0         | 0%          |
| Contract research <sup>3</sup>  | 8,2         | 25%         | 8,1         | 30%         | 6,8         | 22%         | 2,3         | 13%         | 2,0         | 9%          | 3,0         | 13%         |
| Other <sup>4</sup>              | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           |
| <b>Total funding</b>            | <b>33,2</b> | <b>100%</b> | <b>27,4</b> | <b>100%</b> | <b>30,3</b> | <b>100%</b> | <b>18,2</b> | <b>100%</b> | <b>21,1</b> | <b>100%</b> | <b>23,6</b> | <b>100%</b> |
| <i>Expenditure:</i>             |             |             |             |             |             |             |             |             |             |             |             |             |
|                                 | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           |
| Personnel costs <sup>5</sup>    | 1797        | 41%         | 1597        | 37%         | 1878        | 45%         | 1140        | 48%         | 1394        | 46%         | 1554        | 62%         |
| Other costs <sup>6</sup>        | 2585        | 59%         | 2674        | 63%         | 2331        | 55%         | 1236        | 52%         | 1630        | 54%         | 966         | 38%         |
| <b>Total expenditure</b>        | <b>4382</b> | <b>100%</b> | <b>4271</b> | <b>100%</b> | <b>4209</b> | <b>100%</b> | <b>2376</b> | <b>100%</b> | <b>3024</b> | <b>100%</b> | <b>2520</b> | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering / lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organisations and charitable organisations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW).

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead.

**Table 2.3:** Funding and expenditure of the F&R programme in the period 2012-2017

| FR                              | 2012        |             | 2013        |             | 2014        |             | 2015        |             | 2016        |             | 2017        |             |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                 | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           |
| <i>Funding:</i>                 |             |             |             |             |             |             |             |             |             |             |             |             |
| Direct funding IVR <sup>1</sup> | 6,3         | 65%         | 5,4         | 53%         | 5,4         | 42%         | 6,3         | 60%         | 8,4         | 68%         | 7,2         | 68%         |
| Research grants <sup>2</sup>    | 0,0         | 0%          | 0,0         | 0%          | 0,0         | 0%          | 0,0         | 0%          | 0,0         | 0%          | 0,0         | 0%          |
| Contract research <sup>3</sup>  | 3,3         | 35%         | 4,7         | 47%         | 7,4         | 58%         | 4,2         | 40%         | 4,0         | 32%         | 3,3         | 32%         |
| Other <sup>4</sup>              | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           |
| <b>Total funding</b>            | <b>9,6</b>  | <b>100%</b> | <b>10,0</b> | <b>100%</b> | <b>12,9</b> | <b>100%</b> | <b>10,4</b> | <b>100%</b> | <b>12,4</b> | <b>100%</b> | <b>10,5</b> | <b>100%</b> |
| <i>Expenditure:</i>             |             |             |             |             |             |             |             |             |             |             |             |             |
|                                 | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           |
| Personnel costs <sup>5</sup>    | 598         | 26%         | 854         | 44%         | 777         | 65%         | 728         | 44%         | 736         | 52%         | 685         | 58%         |
| Other costs <sup>6</sup>        | 1700        | 74%         | 1067        | 56%         | 424         | 35%         | 935         | 56%         | 684         | 48%         | 494         | 42%         |
| <b>Total expenditure</b>        | <b>2297</b> | <b>100%</b> | <b>1921</b> | <b>100%</b> | <b>1201</b> | <b>100%</b> | <b>1663</b> | <b>100%</b> | <b>1420</b> | <b>100%</b> | <b>1179</b> | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering/ lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organisations and charitable organisations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW).

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead.

**Table 2.4:** Funding and expenditure of the B&W programme in the period 2012-2017

| BW                              | 2012        |             | 2013        |             | 2014        |             | 2015        |             | 2016        |             | 2017        |             |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                 | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           |
| <i>Funding:</i>                 |             |             |             |             |             |             |             |             |             |             |             |             |
| Direct funding IVR <sup>1</sup> | 11,1        | 86%         | 10,0        | 83%         | 9,6         | 83%         | 11,5        | 85%         | 11,9        | 73%         | 8,7         | 62%         |
| Research grants <sup>2</sup>    | 0,0         | 0%          | 0,8         | 7%          | 1,0         | 9%          | 1,0         | 7%          | 3,4         | 21%         | 3,7         | 26%         |
| Contract research <sup>3</sup>  | 1,8         | 14%         | 1,3         | 11%         | 1,0         | 9%          | 1,0         | 7%          | 1,0         | 6%          | 1,7         | 12%         |
| Other <sup>4</sup>              | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           |
| <b>Total funding</b>            | <b>12,9</b> | <b>100%</b> | <b>12,2</b> | <b>100%</b> | <b>11,6</b> | <b>100%</b> | <b>13,5</b> | <b>100%</b> | <b>16,3</b> | <b>100%</b> | <b>14,0</b> | <b>100%</b> |
| <i>Expenditure:</i>             |             |             |             |             |             |             |             |             |             |             |             |             |
|                                 | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           |
| Personnel costs <sup>5</sup>    | 746         | 70%         | 740         | 50%         | 741         | 55%         | 866         | 56%         | 919         | 43%         | 901         | 53%         |
| Other costs <sup>6</sup>        | 325         | 30%         | 740         | 50%         | 602         | 45%         | 687         | 44%         | 1205        | 57%         | 804         | 47%         |
| <b>Total expenditure</b>        | <b>1071</b> | <b>100%</b> | <b>1480</b> | <b>100%</b> | <b>1343</b> | <b>100%</b> | <b>1553</b> | <b>100%</b> | <b>2124</b> | <b>100%</b> | <b>1705</b> | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering / lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organisations and charitable organisations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW).

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead.

**Table 2.5:** Funding and expenditure of the RMSCC programme in the period 2012-2017

| RMSCC                           | 2012        |             | 2013        |             | 2014        |             | 2015        |             | 2016        |             | 2017        |             |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                 | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           |
| <i>Funding:</i>                 |             |             |             |             |             |             |             |             |             |             |             |             |
| Direct funding IVR <sup>1</sup> | 22,0        | 61%         | 19,4        | 64%         | 14,0        | 49%         | 13,5        | 49%         | 12,2        | 42%         | 16,5        | 52%         |
| Research grants <sup>2</sup>    | 3,4         | 9%          | 3,3         | 11%         | 3,6         | 13%         | 3,1         | 11%         | 4,1         | 14%         | 5,2         | 16%         |
| Contract research <sup>3</sup>  | 10,8        | 30%         | 7,4         | 25%         | 10,9        | 38%         | 11,0        | 40%         | 13,1        | 45%         | 10,4        | 32%         |
| Other <sup>4</sup>              | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           |
| <b>Total funding</b>            | <b>36,3</b> | <b>100%</b> | <b>30,1</b> | <b>100%</b> | <b>28,5</b> | <b>100%</b> | <b>27,5</b> | <b>100%</b> | <b>29,4</b> | <b>100%</b> | <b>32,1</b> | <b>100%</b> |
| <i>Expenditure:</i>             |             |             |             |             |             |             |             |             |             |             |             |             |
|                                 | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           |
| Personnel costs <sup>5</sup>    | 2030        | 54%         | 1821        | 44%         | 1699        | 41%         | 1714        | 45%         | 1818        | 44%         | 2087        | 53%         |
| Other costs <sup>6</sup>        | 1705        | 46%         | 2299        | 56%         | 2431        | 59%         | 2130        | 55%         | 2344        | 56%         | 1881        | 47%         |
| <b>Total expenditure</b>        | <b>3735</b> | <b>100%</b> | <b>4119</b> | <b>100%</b> | <b>4130</b> | <b>100%</b> | <b>3844</b> | <b>100%</b> | <b>4162</b> | <b>100%</b> | <b>3968</b> | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering / lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organizations and charitable organizations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW).

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead.

**Table 2.6:** Funding and expenditure of the I&I programme in the period 2012-2017

| I&I                             | 2012        |             | 2013         |             | 2014         |             | 2015         |             | 2016         |             | 2017         |             |
|---------------------------------|-------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
|                                 | FTE         | %           | FTE          | %           | FTE          | %           | FTE          | %           | FTE          | %           | FTE          | %           |
| <i>Funding:</i>                 |             |             |              |             |              |             |              |             |              |             |              |             |
| Direct funding IVR <sup>1</sup> | 31,6        | 41%         | 30,4         | 38%         | 24,7         | 29%         | 29,2         | 34%         | 29,2         | 34%         | 32,1         | 38%         |
| Research grants <sup>2</sup>    | 13,8        | 18%         | 17,2         | 21%         | 19,4         | 23%         | 18,2         | 21%         | 18,2         | 21%         | 17,2         | 20%         |
| Contract research <sup>3</sup>  | 30,7        | 40%         | 33,3         | 41%         | 39,9         | 48%         | 38,2         | 45%         | 38,2         | 45%         | 33,9         | 40%         |
| Other <sup>4</sup>              | -           | -           | -            | -           | -            | -           | -            | -           | -            | -           | 1,7          | 0,0         |
| <b>Total funding</b>            | <b>76,1</b> | <b>100%</b> | <b>80,8</b>  | <b>100%</b> | <b>84,0</b>  | <b>100%</b> | <b>85,6</b>  | <b>100%</b> | <b>85,6</b>  | <b>100%</b> | <b>84,8</b>  | <b>100%</b> |
| <i>Expenditure:</i>             |             |             |              |             |              |             |              |             |              |             |              |             |
|                                 | k€          | %           | k€           | %           | k€           | %           | k€           | %           | k€           | %           | k€           | %           |
| Personnel costs <sup>5</sup>    | 4263        | 47%         | 4608         | 41%         | 5028         | 42%         | 5283         | 50%         | 5283         | 50%         | 5307         | 53%         |
| Other costs <sup>6</sup>        | 4830        | 53%         | 6623         | 59%         | 6929         | 58%         | 5223         | 50%         | 5223         | 50%         | 4728         | 47%         |
| <b>Total expenditure</b>        | <b>9093</b> | <b>100%</b> | <b>11231</b> | <b>100%</b> | <b>11957</b> | <b>100%</b> | <b>10506</b> | <b>100%</b> | <b>10506</b> | <b>100%</b> | <b>10035</b> | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering / lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organisations and charitable organisations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW).

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead.

**Table 2.7:** Funding and expenditure of the RA programme in the period 2012-2017

| RA                              | 2012        |             | 2013        |             | 2014        |             | 2015        |             | 2016        |             | 2017        |             |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                 | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           | FTE         | %           |
| <i>Funding:</i>                 |             |             |             |             |             |             |             |             |             |             |             |             |
| Direct funding IVR <sup>1</sup> | 15,9        | 19%         | 13,9        | 19%         | 12,4        | 19%         | 15,3        | 25%         | 13,2        | 24%         | 11,4        | 24%         |
| Research grants <sup>2</sup>    | 12,8        | 15%         | 12,0        | 16%         | 7,4         | 12%         | 3,0         | 5%          | 1,8         | 3%          | 3,8         | 8%          |
| Contract research <sup>3</sup>  | 54,5        | 65%         | 47,2        | 65%         | 44,7        | 69%         | 43,3        | 70%         | 39,1        | 72%         | 33,4        | 69%         |
| Other <sup>4</sup>              | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           | -           |
| <b>Total funding</b>            | <b>83,2</b> | <b>100%</b> | <b>73,1</b> | <b>100%</b> | <b>64,5</b> | <b>100%</b> | <b>61,5</b> | <b>100%</b> | <b>54,2</b> | <b>100%</b> | <b>48,6</b> | <b>100%</b> |
| <i>Expenditure:</i>             | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           | k€          | %           |
| Personnel costs <sup>5</sup>    | 4321        | 46%         | 4018        | 52%         | 3626        | 46%         | 3575        | 46%         | 3330        | 52%         | 3186        | 80%         |
| Other costs <sup>6</sup>        | 5113        | 54%         | 3697        | 48%         | 4337        | 54%         | 4240        | 54%         | 3022        | 48%         | 796         | 20%         |
| <b>Total expenditure</b>        | <b>9434</b> | <b>100%</b> | <b>7715</b> | <b>100%</b> | <b>7963</b> | <b>100%</b> | <b>7815</b> | <b>100%</b> | <b>6352</b> | <b>100%</b> | <b>3982</b> | <b>100%</b> |

Note 1: Direct funding: funding by Utrecht University - Faculty of Veterinary Medicine (basisfinanciering / lump-sum budget), including '2e geldstroomcomponent' and 'promotiemiddelen'.

Note 2: Research grants obtained in national scientific competition (e.g. grants from NWO, KNAW).

Note 3: Research contracts for specific research projects obtained from external organizations, such as industry, government ministries, European organisations and charitable organisations.

Note 4: Funds that do not fit into the other categories and/or earnings obtained in kind (e.g. personnel in detachment and bench fees from STW).

Note 5: Salaries of research staff only, excluding Support staff.

Note 6: Other costs include salaries of support staff, bench fees, and costs for infrastructure, experimental animals and overhead.

**Appendix 4.** Explanation of the categories utilised

| <b>Category</b> | <b>Meaning</b>              | <b>Research quality</b>  | <b>Relevance to society</b>   | <b>Viability</b>   |
|-----------------|-----------------------------|--|---|--|
| <b>1</b>        | World leading/<br>excellent | The research unit has been shown to be one of the few most influential research groups in the world in its particular field. | The research unit makes an outstanding contribution to society.         | The research unit is excellently equipped for the future.  |
| <b>2</b>        | Very good                   | The research unit conducts very good, internationally recognised research.   | The research unit makes a very good contribution to society.            | The research unit is very well equipped for the future.  |
| <b>3</b>        | Good                        | The research unit conducts good research.  | The research unit makes a good contribution to society.                 | The research unit makes responsible strategic decisions and is therefore well equipped for the future. |
| <b>4</b>        | Unsatisfactory              | The research unit does not achieve satisfactory results in its field.  | The research unit does not make a satisfactory contribution to society. | The research unit is not adequately equipped for the future.   |

**Source:** Standard Evaluation Protocol 2015 – 2021 Amended version, 2016